



## **NOXMAT USERS MANUAL**

This manual describes installation, calibration, and operation of Siemens NOXMAT analyzer. To assure correct operation and accurate results, it is recommended that the user carefully read this document.

Siemens Energy & Automation, Inc.  
7101 Hollister Road  
Houston, TX 77040  
Tel: 713-939-7400

[www.sea.siemens.com/ia](http://www.sea.siemens.com/ia)



**Safety Alert**  
Caution or Warning



**Temperature Hazard**  
Caution or Warning



**Electrical Shock Hazard**  
Caution or Warning

## Safety Information in this Manual


Note, caution and warning symbols appear on the instrument and throughout 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 performance.

A “**WARNING**” safety alert appears with information that is important for protecting you, others and equipment from damage. Pay very 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 under score in a triangle) precedes an elevated temperature hazard CAUTION or WARNING statement.



The  symbol (a lightning bolt in a triangle) precedes an electric 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.

**ALWAYS REMOVE POWER BEFORE CONNECTING OR DISCONNECTING SIGNAL CABLES OR WHEN SERVICING THE EQUIPMENT.**

**The NOXMAT meets or exceeds the following directives and standards.**

Application of Council Directive(s):

*Electrical Safety:*

Low Voltage Directive 73/23/EEC

*Electromagnetic Compatibility:*

EMC Directive 89/336/EEC

Standard(s) to which Conformity is Declared:

*Electrical Safety:*

*Standard for Electrical Equipment for Measurement, Control, and Laboratory Use  
[EN 61010-1:2001 (2nd Edition)]*

*Electromagnetic Compatibility:*

*EN 61326:1997 Electrical equipment for measurement, control and laboratory use - EMC requirements (Amendment A1: 1998 to EN 61326:1997; Amendment A2:2001 to EN 61326:1997)*



Do not apply power to the analyzer or attempt to energize the ozone supply or converter until **ALL** leak checks have been performed and until the analyzer environment has been determined to be non-hazardous.

This analyzer is designed for use in a **NON-HAZARDOUS** environment.

This analyzer is designed for use with a **HAZARDOUS** sample.



Tampering or use of substitute components may cause a safety hazard. Use only factory authorized replacement parts.



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



This analyzer produces high levels of ozone (.4% maximum) that can be dangerous to the health of the operator and surrounding personnel. Be sure to only use this instrument with proper ventilation and exhaust lines.

# TABLE OF CONTENTS

| <b><u>Section</u></b> | <b><u>Title</u></b>                      | <b><u>Page</u></b> |
|-----------------------|--|--------------------|
| <b>1.</b>             | <b>INTRODUCTION -----</b>                | <b>1</b>           |
| 1.1.                  | Overview -----                           | 1                  |
| 1.2.                  | Unpacking Instructions -----             | 1                  |
| 1.3.                  | Reporting Damage -----                   | 1                  |
| 1.4.                  | Contact Information -----                | 1                  |
| 1.5.                  | Warranty Certificate -----               | 2                  |
| <b>2.</b>             | <b>FEATURES AND SPECIFICATIONS -----</b> | <b>3</b>           |
| 3.1.                  | Descriptions -----                       | 3                  |
| 2.2.                  | Features -----                           | 3                  |
| 2.3.                  | Specifications -----                     | 4                  |
| <b>3.</b>             | <b>INSTALLATION -----</b>                | <b>5</b>           |
| 3.1.                  | General -----                            | 5                  |
| 3.2.                  | Site and Mounting -----                  | 5                  |
| 3.3.                  | Electrical -----                         | 5                  |
| 3.4.                  | I/O Analog Connections -----             | 5                  |
| 3.5.                  | Required Gases -----                     | 5                  |
| 3.6.                  | Gas Handling Equipment -----             | 5                  |
| 3.7.                  | Gas Connections -----                    | 5                  |
| 3.8.                  | Sampling Requirements -----              | 7                  |
| 3.8.1.                | Filtration -----                         | 7                  |
| 3.8.2.                | Condensation -----                       | 7                  |
| 3.8.3.                | Presence of Corrosive Gases -----        | 7                  |
| 3.8.4.                | Gas Temperature -----                    | 7                  |
| 3.8.5.                | Flow Rate -----                          | 7                  |
| 3.8.6.                | Sample Gas Outlet -----                  | 8                  |
| <b>4.</b>             | <b>BASIC OPERATION -----</b>             | <b>9</b>           |
| 4.1.                  | Display -----                            | 9                  |
| 4.2.                  | Menu Tree -----                          | 10                 |
| 4.3.                  | Keyboard -----                           | 11                 |
| 4.4.                  | Operation with Cursor Keys -----         | 11                 |
| 4.5.                  | Operation with Function Keys -----       | 11                 |
| 4.6.                  | Read and Change Parameters -----         | 11                 |
| <b>5.</b>             | <b>OPERATING STRUCTURE -----</b>         | <b>12</b>          |
| 5.1.                  | Main Menu -----                          | 12-13              |

|           |   |           |
|-----------|---|-----------|
| <b>6.</b> | <b>MENU STRUCTURE</b>                     | <b>14</b> |
| 6.1.      | User Functions (Level 1)                  | 14        |
| 6.2.      | Advanced User Functions (Level 2)         | 14        |
| 6.3.      | Maintenance User Functions (Level 3)      | 14        |
| 6.4.      | System User Functions (Level 4)           | 14        |
| <b>7.</b> | <b>MAIN MENU</b>                          | <b>15</b> |
| 7.1.      | F1 Measurements                           | 15        |
| 7.1.1.    | F1 NO or NOx Measurement                  | 16        |
| 7.1.2.    | F2 NO + NO2 Measurement                   | 15-16     |
| 7.1.3.    | F3 Diagnostics                            | 16        |
| 7.1.4.    | Arrow Keys to Cycle Ranges and Auto Range | 17        |
| 7.2.      | F2 Purge Analyzer                         | 18        |
| 7.3.      | F3 Diagnostics                            | 18        |
| 7.4.      | F4 Calibrations                           | 19        |
| 7.4.1.    | F1 Automatic Calibration                  | 19-20     |
| 7.4.2.    | F2 Manual Calibration                     | 20-21     |
| 7.4.3.    | F3 Display Deviations                     | 21-22     |
| 7.4.4.    | F4 Check Calibration Values               | 22        |
| 7.4.5.    | F5 Reset Calibration Values               | 22        |
| 7.4.6.    | F6 Range Select                           | 22        |
| 7.5.      | F5 Setup                                  | 23        |
| 7.5.1.    | F1 Span Gas Concentrations                | 24        |
| 7.5.2.    | F2 Calibration Settings                   | 24        |
| 7.5.2.1.  | F1 Times                                  | 24        |
| 7.5.2.2.  | F2 Measuring Deviations                   | 25        |
| 7.5.2.3.  | F3 Deviations                             | 25        |
| 7.5.2.4.  | F4 Calibration via Valves                 | 25        |
| 7.5.2.5.  | F5 Calibration via Probe                  | 25        |
| 7.5.3.    | F3 Range Limits                           | 25        |
| 7.5.3.1.  | F1 Change Upper Range Limits              | 25        |
| 7.5.3.2.  | F2 Change Auto Range Limits               | 26        |
| 7.5.4.    | F4 Change Alarms                          | 26        |
| 7.5.5.    | F5 Password                               | 27        |
| 7.5.5.1.  | F1 Enter Password                         | 27        |
| 7.5.5.2.  | F2 Change Password                        | 27        |
| 7.5.5.3.  | F3 Reset Passwords                        | 28        |
| 7.5.6.    | F6 Linearization                          | 28        |
| 7.5.7.    | F7 System Settings                        | 29        |
| 7.5.7.1.  | F1 Clock Setup                            | 29-30     |
| 7.5.7.2.  | F2 TCP/IP Address                         | 31        |
| 7.5.7.3.  | F3 Output Signal Assignments              | 31        |
| 7.5.5.4.  | F4 Output Ranges                          | 31        |

|            |   |           |
|------------|---|-----------|
| 7.5.7.5.   | F5 Protocol On/Off -----                      | 32        |
| 7.5.7.6.   | F6 Set Language -----                         | 32        |
| 7.5.7.7.   | F7 Automatic Setup -----                      | 32        |
| 7.5.8.     | F8 Measure Settings -----                     | 33        |
| 7.5.8.1.   | F1 Set Purge Time Before Measure -----        | 33        |
| 7.5.8.2.   | F2 Set Converter Efficiency -----             | 33        |
| 7.5.8.3.   | F3 Set Time Constant -----                    | 34        |
| 7.5.8.4.   | F4 Set Purge Time Before Calibration -----    | 34        |
| 7.5.10.    | F10 Display Software Version -----            | 34-35     |
| 7.6.       | F7 Remote/Manual Operation -----              | 35        |
| 7.7.       | F8 Standby -----                              | 35        |
| <b>8.</b>  | <b>ANALYZER COMPONENTS -----</b>              | <b>36</b> |
| 8.1.       | Rear Panel Connections -----                  | 37        |
| 8.1.1.     | Main Analog Connections -----                 | 37        |
| 8.1.2.     | Auxiliary Analog Connections -----            | 37        |
| 8.1.3.     | Digital (RS-232) Connections -----            | 37        |
| 8.1.4.     | Digital (TCP/IP) Connections -----            | 38        |
| 8.2.       | Internal Components -----                     | 39        |
| 8.3.       | Main Electronics Board (Potentiometers) ----- | 40        |
| 8.4.       | Main Electronics Board (Connections) -----    | 41        |
| 8.5.       | Reaction Chamber -----                        | 42        |
| 8.6.       | Relay Board (Connections) -----               | 43        |
| <b>9.</b>  | <b>OPERATION -----</b>                        | <b>44</b> |
| 9.1.       | Preparation -----                             | 44        |
| 9.2.       | Operation -----                               | 44-45     |
| 9.3.       | Shut Down Procedure -----                     | 46        |
| <b>10.</b> | <b>FUNCTIONAL DESCRIPTION -----</b>           | <b>47</b> |
| 10.1.      | Operating Principle -----                     | 47        |
| 10.2.      | Reaction Chamber Assembly -----               | 47        |
| 10.3.      | Flow System -----                             | 47        |
| 10.4.      | Main Electronics Board -----                  | 48        |
| 10.5.      | Relay Board -----                             | 48        |
| <b>11.</b> | <b>REACTION CHAMBER -----</b>                 | <b>49</b> |
| 11.1.      | Reaction Chamber Disassembly -----            | 49        |
| 11.2.      | Reaction Chamber Assembly -----               | 49        |
| <b>12.</b> | <b>TROUBLESHOOTING -----</b>                  | <b>50</b> |
| 12.1.      | Ozone Air/O <sub>2</sub> Supply -----         | 50        |
| 12.2.      | Sample Supply -----                           | 50        |
| 12.3.      | NO/NO <sub>x</sub> Converter -----            | 50        |
| <b>13.</b> | <b>APPENDIX -----</b>                         | <b>51</b> |
| 13.1.      | AK Protocol -----                             | 52-63     |

13.2. Output Connections----- **64**

13.3. Flow Diagrams ----- **65-68**

13.3. Electrical Block Diagram----- **69**



## **1. Introduction**

### ***1.1. Overview***

Congratulations and thank you! You have just purchased one of the most reliable gas analyzers in the world. Before using the analyzer, please familiarize yourself with its operation by reading this manual. If you have any questions, please do not hesitate to call Siemens for assistance. We want you to be a member of our thousands of satisfied customers.

### ***1.2. 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 all circuit boards and circuit board connections are secure. If all internal components look normal, re-install the cover.

### ***1.3. 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 shipper. The shipping container or packing materials should be retained for inspection by the shipper.

### ***1.4. Contact Information***

Siemens Energy & Automation, Inc.  
7101 Hollister Road  
Houston, TX 77040  
Phone 713-939-7400  
Fax 713-939-9050  
Website: [www.sea.siemens.com/ia](http://www.sea.siemens.com/ia)

### 1.5. Warranty Certificate

Subject to the exceptions and upon the conditions stated below, Siemens warrants that the products sold under this sales order shall be free from defects in workmanship and materials for one year after delivery of the product to the original Buyer by Siemens and if any such product should prove to be defective within such one year period, Siemens agrees, at its option, either (i) to correct by repair or, at Siemens election, by replacement with equivalent product any such defective product, provided that investigation and factory inspection discloses that such defect developed under normal and proper uses, or (ii) to refund the purchase price. The exceptions and conditions mentioned above are as follows:

- a) components or accessories manufactured by Siemens which by their nature are not intended to and will not function for one year are warranted only to give reasonable service for a reasonable time; which constitutes reasonable time and reasonable services shall be determined solely by Siemens. A complete list of such components and accessories is maintained at the factory;
- b) Siemens makes no warranty with respect to components or accessories not manufactured by it; in the event of defect in any such component or accessory Siemens will give reasonable assistance to Buyer in obtaining from the respective manufacturer whatever adjustment is authorized by the manufacturer's warranty;
- c) any product claimed to be defective must be returned to the factory transportation, charges prepaid and Siemens will return the repaired or replaced product freight collect;
- d) if the product claimed to be defective requires on-site repair, such warranty labor will be provided at no charge; however, transportation and living expenses will be charged to Buyer;
- e) if the product is a consumable or the like, it is warranted only to conform to the quantity and content and for the period (but not in excess of one year) stated on the label at the time of delivery or 90 days;
- f) Siemens may from time to time provide a special printed warranty with respect to a certain product, and where applicable, such warranty shall be deemed incorporated herein by reference;
- g) Siemens shall be released from all obligations under all warranties, either expressed or implied, if any product covered hereby is repaired or modified by persons other than its own authorized service personnel unless such repair by others is made with the written consent of CAI.

IT IS EXPRESSLY AGREED THAT THE ABOVE WARRANTY SHALL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND OF THE WARRANTY OF MERCHANTABILITY AND THAT SIEMENS SHALL HAVE NO LIABILITY FOR SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND OR FROM ANY CAUSE WHATSOEVER ARISING OUT OF THE MANUFACTURE USE, SALE, HANDLING, REPAIR, MAINTENANCE OR REPLACEMENT OF ANY OF THE PRODUCTS SOLD UNDER THIS SALES ORDER. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THAT THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS, WHICH VARY FROM STATE TO STATE.

Representations and warranties made by any person, including dealers and representatives of Siemens, which are inconsistent, or in conflict with the terms of this warranty, shall not be binding upon Siemens unless reduced to writing and approved by an expressly authorized officer of Siemens.

## **2. Features**

### **2.1. Description**

The Siemens NOXMAT Analyzer is a highly sensitive heated chemiluminescent (CLD) gas analyzer for measuring gas concentrations in industrial and vehicle emission applications. The analyzer includes a unique internal oven, which maintains ALL plumbing components in contact with the sample gas, before the detector, at an elevated temperature between 65 and 100 degrees Centigrade. (Temperature is Customer Specified)

### **2.2. Features-General**

The Siemens NOXMAT analyzer has a 3 by 5 inch liquid crystal display and a 20 key data/operation input keyboard. The 16 bit microprocessor control board consists of the MSR-Card with 16 digital inputs, 16 digital outputs, 16 analog inputs and 4 analog outputs. The analyzer can be manually operated from the keypad or remotely via TCP/IP or Rs-232C communications. After turning on the analyzer, it needs at least 30 seconds for initialization. During this time, the screen is illuminated but clear. The analyzer is available with an optional internal heated sample pump.

**IMPORTANT TIP:** When the analyzer is powered up, it defaults to access level 1 (User). To operate ALL parameters, check the access level. See Section 5.5.5.

The contents of this manual include:

- **Electrical Specifications**
- **Installation Requirements, Mechanical & Electrical**
- **Operation & Calibration Instructions**
- **Reaction Chamber Description with Procedures for Disassembly of its Component Parts**
- **Function Explanation of the Electronic Circuitry**
- **Block Electrical Diagram**

## Siemens NOXMAT Analyzer Specifications

|  |   |  |
|--|---|--|
| <b>DETECTOR</b>  | Chemiluminescence (CLD) Photodiode (thermally stabilized with Peltier cooler)   |  |
| <b>NO/NO<sub>x</sub> RANGES</b>                        | 0-1 to 3,000 ppm NO or NO <sub>x</sub> (Four user programmable ranges)<br>(Higher Ranges Available upon Request)  |  |
| <b>RESPONSE TIME</b>                                   | T <sub>90</sub> < 2 Seconds to 60 Seconds Adjustable  |  |
| <b>RESOLUTION</b>                                      | 10 ppb NO/NO <sub>x</sub> (Displays 5 significant digits)   |  |
| <b>REPEATABILITY</b>                                   | Better than 0.5% of Full Scale  |  |
| <b>LINEARITY</b>                                       | Better than 0.5% of Full Scale  |  |
| <b>NOISE</b>   | Less than 1% of Full Scale  |  |
| <b>ZERO &amp; SPAN DRIFT</b>                           | Less than 1% of Full Scale per 24 Hours   |  |
| <b>ZERO &amp; SPAN ADJ.</b>                            | Via front panel, TCP/IP or RS-232   |  |
| <b>NH<sub>3</sub>, HCN &amp; SO<sub>2</sub> EFFECT</b> | Not detectable with 100 ppm   |  |
| <b>CO<sub>2</sub> EFFECT</b>                           | Less than 0.5% with 10% CO <sub>2</sub>   |  |
| <b>FLOW CONTROL</b>                                    | Electronic Proportional Pressure Controller   |  |
| <b>SAMPLE FLOW RATE</b>                                | .5 to 3.0 LPM (See footnote below)  |  |
| <b>CONVERTER</b>                                       | Vitreous Carbon Material @ 205°C > 98% efficiency   |  |
| <b>OZONATOR</b>  | Ultraviolet Lamp  |  |
| <b>AIR OR O<sub>2</sub> REQUIREMENTS</b>               | Less than 0.01 ppm NO <sub>x</sub> at 350 cc/Min. @ 25 psig (Dew Point < -35°C)   |  |
| <b>NO/NO<sub>x</sub> Control</b>                       | Manual/Remote/Auto Cycle (Remote NO <sub>x</sub> mode by dry contact closure)   |  |
| <b>OUTPUTS</b>   | TCP/IP, RS232, Four Scalable Analog 0-10 V / 4-20 mA Maximum  |  |
| <b>DISCRETE ALARMS</b><br>(Local & Remote Adjustable)  | General Fault/ TTL Logic (Ground True) 0-5 VDC Maximum<br>Calibration Failure/ TTL Logic (Ground True) 0-5 VDC Maximum<br>High Concentration (2 each)/ TTL Logic (Ground True) 0-5 VDC Maximum      |  |
| <b>DIGITAL DIAGNOSTICS</b>                             | Control Voltages<br>Temperatures  | Pressures<br>Flow Parameters   |
| <b>KEYPAD DISPLAYS</b>                                 | Factory Settings<br>TCP/IP Address<br>Passwords (4)   | Scalable Analog Output Voltages<br>Full Scale Range Select<br>Auto Cal Times |
| <b>SPECIAL FEATURES</b>                                | Calculated NO <sub>2</sub> derived from NO <sub>x</sub> converter efficiency<br>Auto Ranging<br>Auto Calibration (adjustable through internal clock)<br>Less than 3 cc Gold Plated Reaction Chamber |  |
| <b>DISPLAY</b>   | 3" x 5" Back lit LCD  |  |
| <b>SAMPLE TEMPERATURE</b>                              | Up to 75°C Noncondensing – Standard (Higher temperature available upon request)   |  |
| <b>AMBIENT TEMPERATURE</b>                             | 5 to 40°C   |  |
| <b>AMBIENT HUMIDITY</b>                                | Less than 90% RH Noncondensing  |  |
| <b>WARM-UP TIME</b>                                    | 1 Hour (Typical)  |  |
| <b>FITTINGS</b>  | 1/4 Inch Tube   |  |
| <b>POWER</b>   | 120 VAC; 60Hz; 4 Amp Maximum  |  |
| <b>DIMENSIONS</b>                                      | 5¼ H x 19 W x 23 D (Inches)   |  |

Note: .5 to 1.5 l/min flow rate options available upon request only

## Section 3

# INSTALLATION

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### 3. Installation

#### 3.1. General

The instrument is designed for industrial applications. These installation instructions are for a typical site. Any questions regarding specific installation situations should be directed to Technical Service of Siemens.

#### 3.2. Site and Mounting

**NOTE: 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. The instrument must not be subject 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.
6. Do not install near equipment emitting electromagnetic interference (EMI).

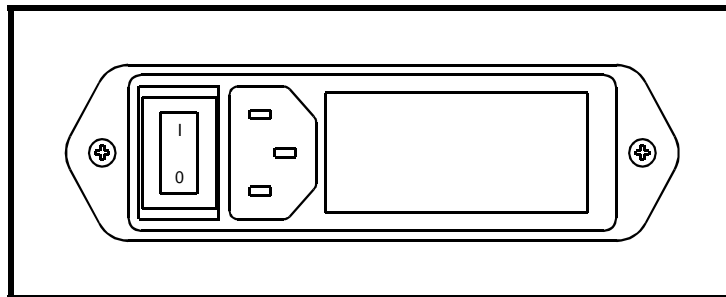
**NOTE: A rear supporting brace or equivalent is required if the optional rack mount slides were not purchased.**



**The power on/off switch is accessible from the rear of the instrument only. DO NOT mount such that the power on/off switch is inaccessible.**

#### 3.3. Electrical

All wiring is connected at the rear of the instrument. Connect outputs, etc. as shown in Table 3-1 on the following page. The AC power is connected to the power/fuse/switch as shown below.



**AC Power Switch, Connector, and Fuse.**

## Section 3

# INSTALLATION

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**NOTE:** A defective ground may affect the operation of the instrument. The output voltages are connected per Table 8.1-1. Shielded wiring is recommended for output signals.



**Replace fuses with recommended fuse size indicated on rear panel of instrument. Replacement with any other size fuse may cause damage to the instrument and possible injury to operating personnel.**

### **3.4. Analog Output Connections (Appendix)**

See Appendix for connector pinouts located on the analyzer rear panel. Remote range identification and range selection are obtained by the rear panel connections. When a range is selected, the corresponding control line is pulled low to zero VDC. Ranges not selected will remain at approximately 5 VDC. When remote range control is selected through the front panel keypad, a contact closure is provided at the rear panel connector. Remote range selection is made by connection of the control line for the desired range to the analyzers zero VDC line provided in the connector. Five VDC is also provided. Remote NOx On is selected by connection to the common line. This contact closure turns on the NOx function by flowing the sample first through the NO/NOx converter.

### **3.5. Gases**

1. Air or O<sub>2</sub> (Ozone Air, < 1 ppm C) in pressurized cylinder.
2. Nitrogen or (zero air) in pressurized cylinder.
3. Standard span gas(es) near full scale concentration with a nitrogen balance, in a pressurized, certified cylinder.

### **3.6. Gas Handling Equipment**

1. Pressure regulators for zero gas (Air or N<sub>2</sub>), ozone supply (air or O<sub>2</sub>) and span gas cylinders.
2. Corrosive resistant gas tubing.



**High levels of Ammonia (greater than 10 PPM NH<sub>3</sub>) may reduce the NO<sub>2</sub> to NO Converter's conversion efficiency to a level that is unacceptable. It is therefore recommended that the customer purchase a commercially available NH<sub>3</sub> scrubber and install it in the path of the sample gas prior to its introduction into the analyzer.**

## Section 3

# INSTALLATION

---

### 3.7. Gas Connections

The tubing from the sampling system to the gas analyzer should be made from corrosive-resistant material such as Teflon, stainless steel. Even when the gases being sampled are corrosive themselves, rubber or soft vinyl tubing should not be used since readings may be inaccurate due to gas absorption into the piping material. To obtain fast response, the tube should be as short as possible. Optimum tube internal diameter is 0.16 inch (4 mm). Couplings to the instrument are ¼ Inch tube.

#### **NOTE**

**Be sure tubing and joints are clean.  
Dust entering the instrument may cause it to malfunction.**

### 3.8. Sampling Requirements

#### 3.8.1. Filtration

Dust must be eliminated completely. Use filters as necessary. The final filter must be capable of removing particles larger than 4 microns.

#### 3.8.2. Condensation

Dew point of the sample gases must be lower than the temperature of the oven to prevent accidental condensation within the instrument. When sample dew point is greater than the oven's preset temperature, pass the sample through a dehumidifier to reduce the dew point to prevent condensation. If the sample contains an acid mist, use an acid mist filter, cooler or similar device to remove all traces of the mist.

#### 3.8.3. Presence of Corrosive Gases

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.

#### 3.8.4. Gas Temperature

When measuring high temperature gases, take care that the maximum rating of the instrument 122°F (100°C) is not exceeded.

#### 3.8.5 Pressure and Flow Rates

The air or oxygen supply entering the instrument is controlled by an electronically controlled proportional flow (EPC) controller. The regulator is factory adjusted for optimum analyzer performance. The ozone supply (Air or O<sub>2</sub>) air cylinder pressure should be set at approximately 25 PSIG. The sample entering the instrument is controlled by a factory set precision electronically controlled proportional flow (EPC) controller. The EPC is factory set for optimum analyzer performance as indicated by the sample pressure. If the analyzer does not contain the optional heated sample pump, the sample gas entering the instrument should be at a pressure between 10 and 25 PSIG with a flow capacity at a minimum of 3 liters/min. If the analyzer contains the optional sample pump, do not apply a pressurized sample. The optional pump is capable of drawing a sample through a ¼ inch heated sample line of approximately 75 feet. The calibration/span gas cylinder pressures should be set at 25 PSIG for delivery into the optional zero and span inlets located on the rear panel.

## Section 3

### INSTALLATION

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#### **3.8.6. Sample Gas Bypass Outlet (Vent)**

A sample gas bypass outlet connector is located on the rear panel (¼ Inch Tube). Pressure at this outlet should be kept at atmospheric level. **ANY** backpressure will cause an error in reading. The vent outlet is located on the rear panel and may contain high levels of ozone which should be vented away from the instrument.

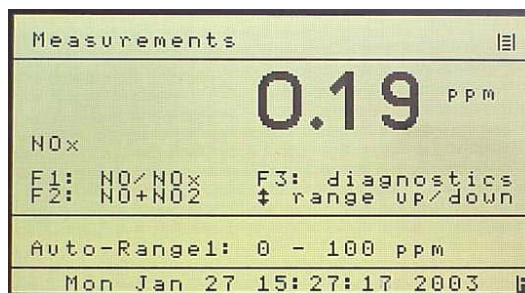


## 4. Basic Operation

The operation of the digital microprocessor conforms to the guidelines of the AK committee, originally developed in the German automotive industry. Via the serial port of the MSR-Card, the analyzer can be remote-controlled by a master computer. The serial communication fully corresponds to the specifications of the AK protocol. TCP/IP communication is also available.

### 4.1. Display

The analyzer's LCD display can show 16 lines with 30 characters each. The display also has background lighting that can be switched on and off via the Display key on the keyboard. The following example shows the measurement screen which is formatted into 4 information areas.



Measurement Screen

#### THE TOP INFORMATION AREA CONTAINS:

The AK Protocol Information. This capability is for advanced uses and may be toggled on and off in the setup screen, F5. Next to the symbol for the active operating mode, the device status is indicated. The status field is also displayed on all other screens.

SARE    Autorange enabled  
SMGA    Measuring gas is flowing  
SMAN    Device is in manual operation status

The level of Password Entry is shown on the right with 4 horizontal lines.

#### THE LARGE INFORMATION AREA CONTAINS:

The Concentration of the gas sample and mode of operation.

#### THE THIRD INFORMATION AREA CONTAINS:

The help information for the parameter selected, ranges, etc.

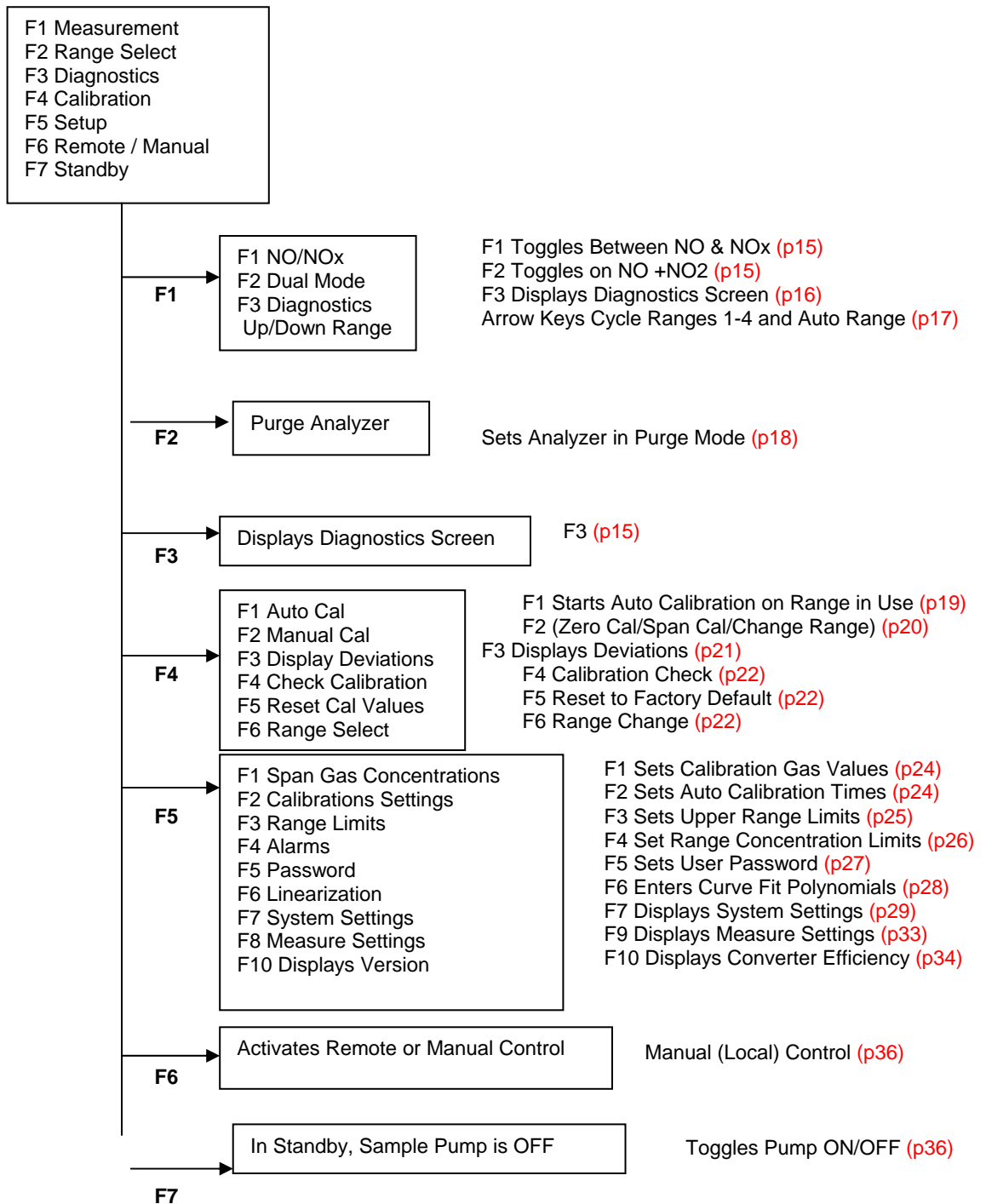
#### THE LOWER INFORMATION AREA CONTAINS:

The time & date and any error condition.

The symbol in the bottom right corner indicates the keyboard mode. In the example shown, the keyboard is in the function key mode. For input fields, the mode is usually switched to numerical input. Then, an N appears in the lower right of the screen. This symbol is displayed on all screens.

### 4.2. Menu Tree

Main Menu (from "Main" Key) (p12)



### 4.2. Keyboard

The keyboard looks as follows:

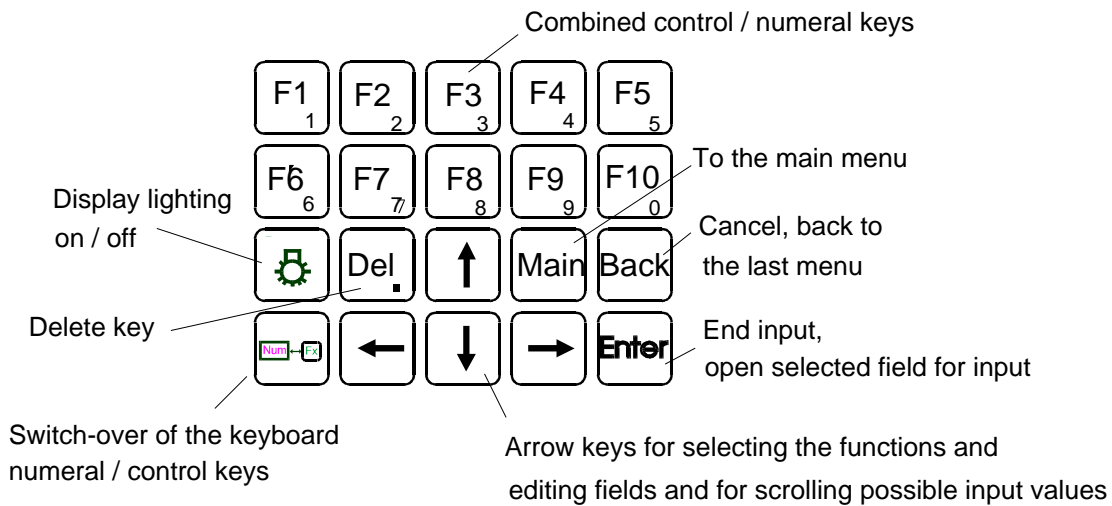


Figure 2 : Keyboard

### 4.3. Operation with the Cursor Keys and the Enter Key

When operating the unit with the cursor keys, you select the various functions with the up/down cursor keys and start them with the Enter key. This method is particularly suitable for less proficient users since the system displays a short on-line help for nearly every function selected. The actual cursor position is shown as a black horizontal bar.

**TIP:** If you are not yet familiar with the screens and their fields, just press any cursor key after a screen appears. This moves the cursor from field to field and displays the corresponding online help.

### 4.4. Operation with the Function Keys

When using the function keys (F1 through F10), you call functions directly by pressing their corresponding function keys. This method is suitable for the advanced user since it is faster than the operation with the cursor keys. There is, however, no on-line help for the various functions.

### 4.5. Read/Change Parameters

To read and/or change parameters, you must switch to the parameter input mode by pressing the Enter key after calling the corresponding parameter screen. The input cursor (horizontal bar under the first character) then appears in the active edit field (black background). The cursor can be positioned with the right and left cursor keys, and the value displayed (number or letter) can be changed with the up and down cursor keys or entered directly. Every input has to be concluded by pressing the Enter key again, which causes the cursor to disappear.

## 5. Operating Structure

The analyzer's operation can be divided into up to 4 operating levels. The current level is always displayed as a stack of 1 to 4 horizontal bars in the top right corner of the screen. In the access level menu, you can choose between the following operating levels:

|    |               |                     |
|----|---------------|---------------------|
| F1 | User          | (operating level 1) |
| F2 | Advanced user | (operating level 2) |
| F3 | Maintenance   | (operating level 3) |
| F4 | System user   | (operating level 4) |

A password can be assigned to each operating level. Only the system user, who normally has the highest operating priority, can assign the password. At the factory, the default passwords for the Siemens analyzers are set as follows:

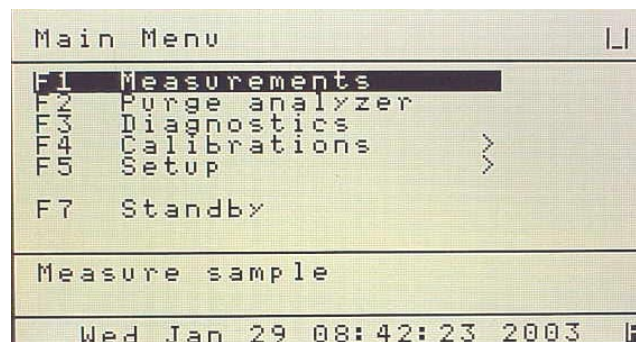
|                |     |
|----------------|-----|
| User:          | 111 |
| Advanced user: | 222 |
| Maintenance:   | 333 |
| System:        | 444 |

The default setting can be changed only by the system user. This manual is written to include all information for the advanced system user.

**TIP:** Because of the user settings, some of the parameters shown in this manual may not appear on your analyzer. Check the access level.

### 5.1. The Main Menu

Upon power up, the Siemens logo is first displayed and then the main menu appears as below:



**NOTE:**  
Access  
Level  
Indication

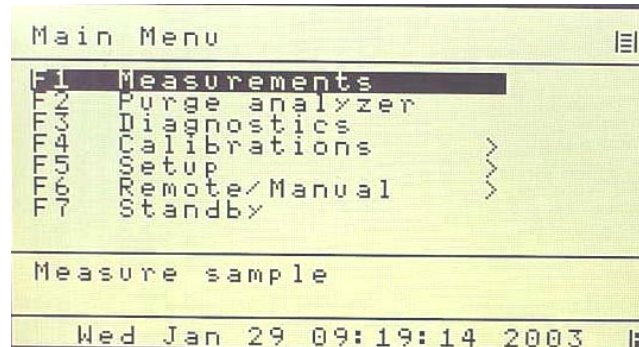
**Main Menu on Power Up Screen**

**NOTE:** F6 is not available because, on initial start up, the analyzer reverts to ONLY Level 1 access. See Section 7.5.5 for Password information.

All functions can be selected with the cursor keys and activated by pressing the Enter key, or directly with the function keys F1 through F7. A ">" to the right of a function means that one or more sub-menus are available. If this sign is missing, the function starts immediately after the activation.

**NOTE:** Access level is 4.

**NOTE:**  
Access  
Level  
Indication



Main User Menu (Level 4)

## 6. Menu Structure

There are 4 operating levels based on the level of your password. This section shows the access rights of the single levels.

### 6.1. User Functions (Level 1)

#### Main Menu

F1 : Measurements  
F2 : Purge Analyzer  
F3 : Diagnostics  
F4 : Calibrations  
F5 : Setup  
F7 : Standby

#### F5 :Setup

F5 : Password  
F10:Version

#### F5 :Password

F1 :Enter password

### 6.2. Advanced User Functions (Level 2)

#### Main Menu

F1 : Measurements  
F2 : Purge Analyzer  
F3 : Diagnostics  
F4 : Calibrations  
F5 : Setup  
F7 : Standby

#### F5 : Setup

F3 : Range Limits  
F5 : Password  
F10:Version

#### F5 :Password

F1 :Enter password

### 6.3. Maintenance Functions (Level 3)

#### Main Menu

F1 : Measurements  
F2 : Purge Analyzer  
F3 : Diagnostics  
F4 : Calibrations  
F5 : Setup  
F7 : Standby

#### F5 : Setup

F1 : Span Gas Conc.  
F3 : Range limits  
F5 : Password  
F7 : System Settings  
F8 : Measure Settings  
F10:Version

#### F5 :Password

F1 :Enter password  
F2 :Reset password

#### F7:System Settings

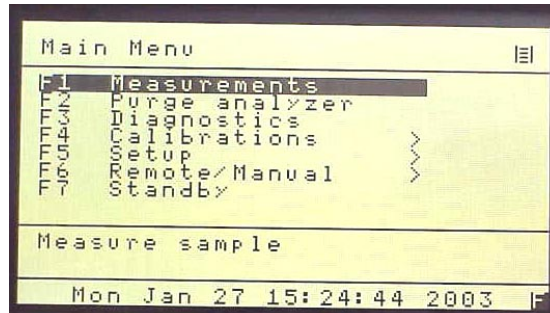
F1 : Real Time Clock  
F5 : Status Line on/off  
F7 : Auto Startup

### 6.4. System User Functions (Level 4)

All Function described in this manual may be accessed from Level 4.

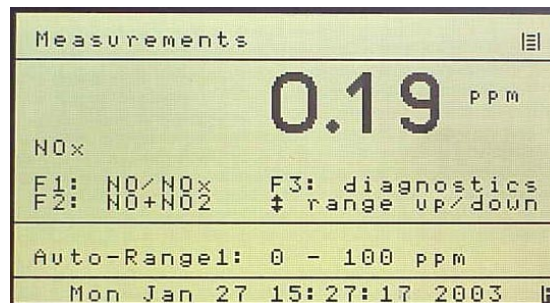
## 7. Main Menu Function Descriptions

### 7.1. F1 Measurements



#### 7.1.1. F1 NO or NOx Measurement

The measurements screen is activated by pressing F1 on the Main Menu screen. The NO/NOx content is displayed in ppm. Pressing F1 switches between measuring the sample gas for NOx or NO only. When the converter is off, only NO is measured. When the converter is on, NOx is measured.



Measurement sScreen

#### 7.1.2. F2 NO + NOx Measurement

The F2 function activates the "hold and sample" feature which allows the analyzer to automatically switch between NO and NOx measurement. The time duration for the sample read is set up in the Setup Menu. The analyzer will read and display the NO (converter is bypassed) value. At the predetermined time, it will switch to the NOx mode (through converter) and read and display the NOx value, while the last 15 second NO average is displayed. The top value will be "real time" values and will change between NO and NOx. The difference between the two average values is shown as NO2. All three values are sent to the analog and digital outputs.



| Measurements             |         |     |  |
|--------------------------|---------|-----|--|
| NOx                      | 0 . 1 7 | ppm |  |
| NO                       | 0 . 1 7 | ppm |  |
| NO2                      | 0 . 0 0 | ppm |  |
| F1: NO/NOx               |         |     |  |
| Auto-Range1: 0 - 100 ppm |         |     |  |
| Mon Jan 27 15:27:47 2003 |         |     |  |

NO/NOx/NO2 Screen

### 7.1.3. F3 Diagnostics

F3 activates the diagnostic screen where pressures, flow rates, temperatures and EPC control voltages are displayed in real time. The units are psig, degrees C, ml/min. and voltage. Use the arrow key to switch between diagnostic screens.

| Diagnostics I              |  |  |
|----------------------------|--|--|
| Temperatures: Cell : 66.27 |  |  |
| [°C] Diode : -5.21         |  |  |
| Conv. : 205.00             |  |  |
| page 1/2                   |  |  |
| next screen >              |  |  |
| Mon Jan 27 15:31:47 2003   |  |  |

First Diagnostics Screen

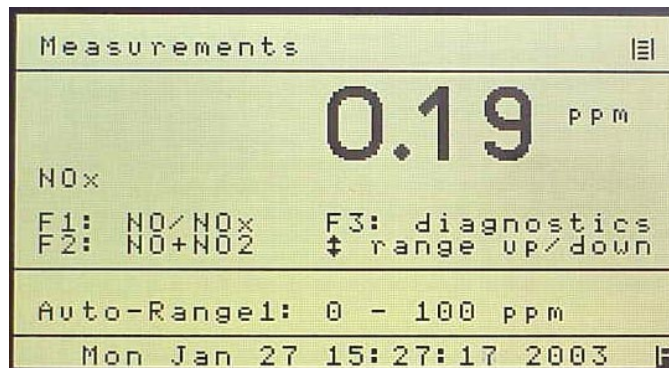
| Diagnostics II           |  |  |
|--------------------------|--|--|
| EPC Coil: Sample: 5.76   |  |  |
| [V] Ozone : 9.51         |  |  |
| Pressures: Sample: 3.85  |  |  |
| [PSIG] Air : -0.05       |  |  |
| Gas Flow: Sample: 60.24  |  |  |
| mL/Min Air : 0.00        |  |  |
| page 2/2                 |  |  |
| < previous screen        |  |  |
| Mon Jan 27 15:32:03 2003 |  |  |

Second Diagnostics Screen

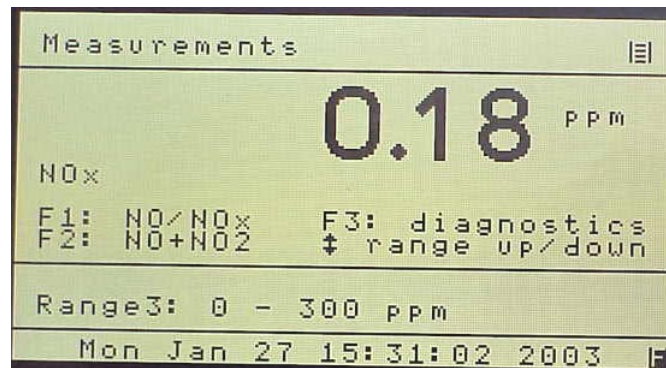


#### 7.1.4. Range Select

With the arrow keys, the ranges 1 to 4 can be selected and locked in which will disable the auto range capability. Continue pressing the arrow keys will recycle the analyzer back to auto range. The range and/or auto range is displayed on the measurement screen. If the limits are exceeded while not in the auto range mode, a warning "Over Range" appears on the screen.

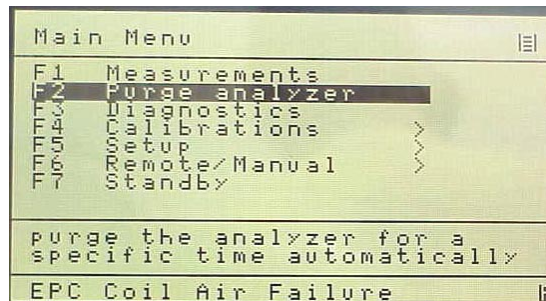


Set to Auto-Range

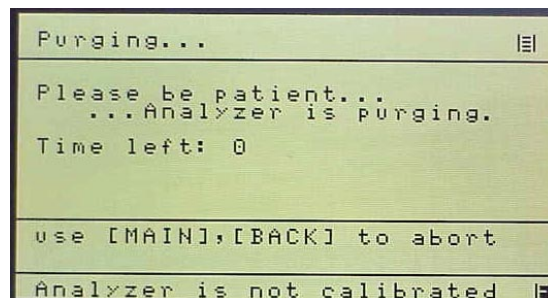


Analyzer Set to Range 3

### 7.2. F2 Purge Analyzer



Main Menu (User Level 4)

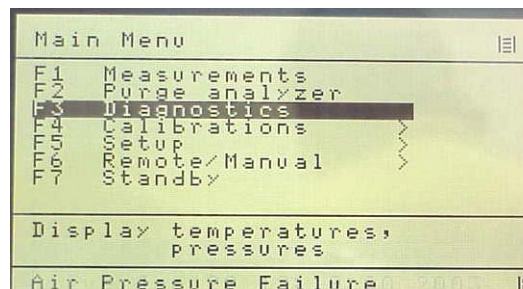


Purge Screen

F2 from the Main Menu activates the Purge (analyzer) function if equipped.

### 7.3. F3 Diagnostics

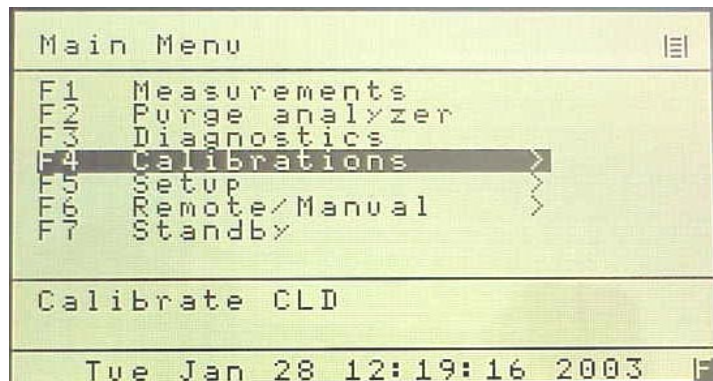
F3 from the Main Menu activates the Diagnostics function. As described in Section 7.1.3, F3 brings up the two diagnostics screens. The Diagnostics screens may be brought up from **EITHER** the Main Menu or the Measurements screen.



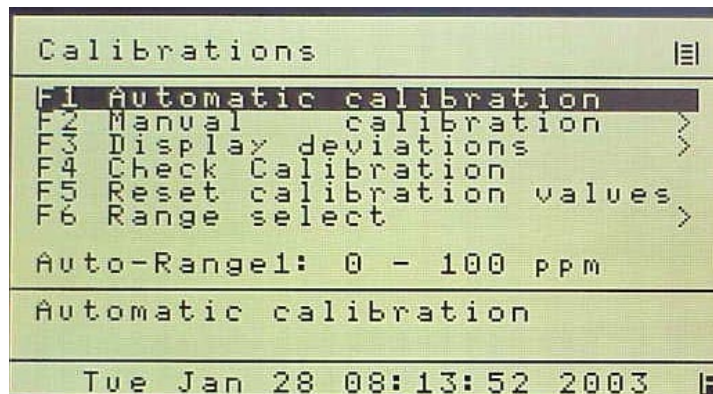
Main User Menu (Level 4)

### 7.4. F4 Calibrations

F4 from the Main Menu activates the Calibrations screen. Calibrations may be automatic or manual. Deviations can also be displayed. Calibration values can be reset to default values and the range to be calibrated can be changed.



Main Menu (User Level 4)

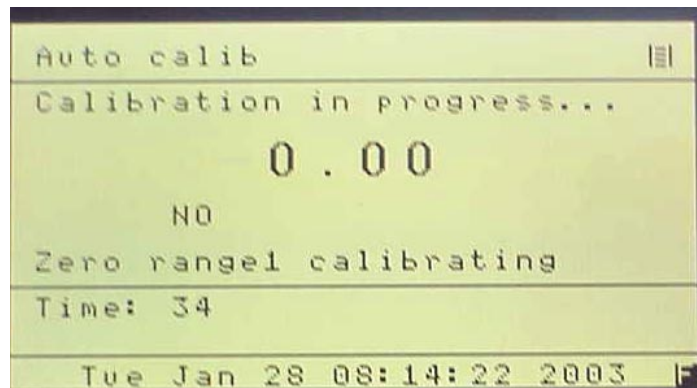


Calibration Screen

#### 7.4.1. F1 Automatic Calibration

From the Calibrations screen, F1 starts automatic calibration. If auto range is selected, the actual range in use will be calibrated. Auto calibration works as follows: First zero gas is purged a certain time, called purge-time. Then the measurement begins. The measured value must be a minimum-time, called measuring-time and within an upper and a lower limit to be saved as new offset value. The maximum length of measuring time is 9 seconds. If the measured value was constant during calibration time, it is checked to determine if this value deviates from the preceding value. If the deviations are too large, a warning "Deviation error!" appears and the user can choose if the new value is saved or not. At last, the zero gas is flown a further time, verifying time, so it can be checked if the signal is still constant. All of these times can be changed. After zero gas calibration, the same happens with span gas. During auto calibration "Calibration in progress" is displayed. It also shows,

which gas is flowing and which time runs. When auto calibration has finished it is displayed. If the span value of the selected range is 0 (see section 5.6.1), then it will not be calibrated. If one range is calibrated and the span value for the lower ranges is zero, calibration parameters will be copied to this range. To calibrate all ranges with the same span gas, you must enter the gas concentration in the Span Gas Calibration screen for ALL RANGES. You must also calibrate each range. Offsets and scalors are NOT copied to other ranges.

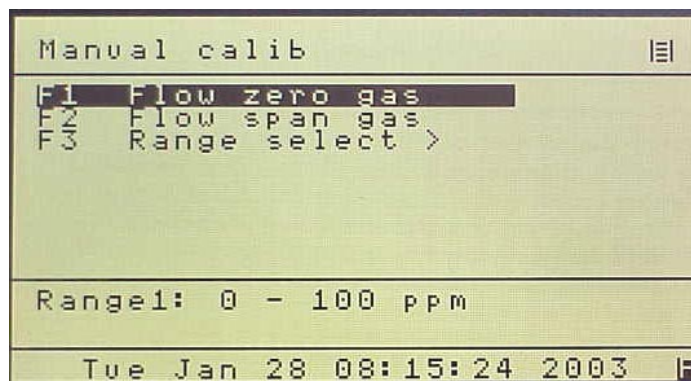


Auto Calibration Screen

#### 7.4.2. F2 Manual Calibration

From the Calibration screen, F2 starts manual calibration. If auto range is selected, calibration is not possible, and the appropriate range can be selected. In the manual calibrations menu, three options are possible:

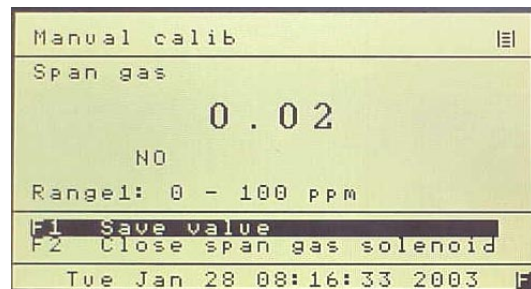
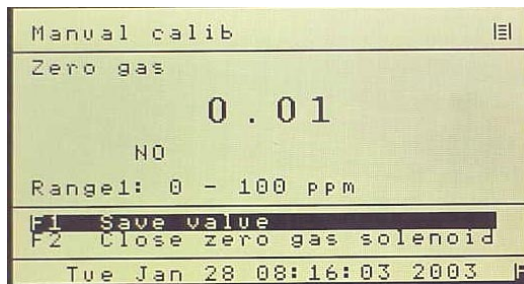
- F1 Flow zero gas
- F2 Flow span gas
- F3 Range select



Manual Calibration Screen

When zero or span gas is flown, the measured value can be saved by pressing F1. If the screen is left by pressing the buttons "Main" or "Back", the measured value is not saved. Solenoids are closed by pressing F2. From the manual calibration menu, the range to calibrate can be chosen by pressing F3.





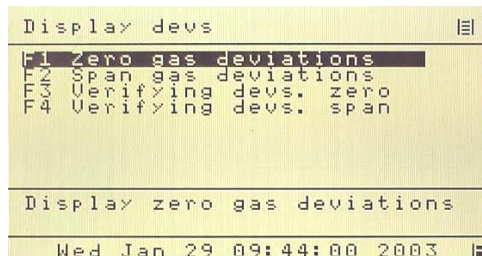
Manual Zero and Span Calibration Screens

### 5.4.3. F3 Display Deviations

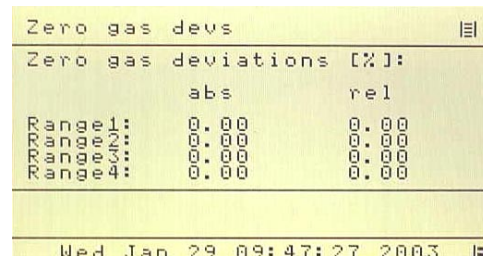
After every calibration, the deviations are calculated for zero and for span gas.

- F1 shows zero gas deviations
- F2 shows span gas deviations
- F3 Deviations of zero gas during verifying
- F4 Deviations of span gas during verifying

F1 and F2 deviations are displayed in percent.



Deviation Screen



Zero Gas Deviations

During calibration there is a verification for zero and span gas. With option F3 and F4 you can view the deviations during the verification time. Absolute deviation is the absolute average difference from the saved value in ppm. Relative deviation is the absolute average difference in percent, related to the range limit.

**7.4.3.1 Absolute Zero Gas Deviation**

Absolute zero gas deviation is zero gas content calculated by the factory polynom related to the range limit of the calibrated range.

**7.4.3.2. Relative Zero Gas Deviation**

Relative zero gas deviation is the actual deviation minus the deviation of the previous calibration related to the range limit of the calibrated range.

**7.4.3.3. Absolute Span Gas Deviation**

Absolute span gas deviation is span gas bottle value minus span gas value calculated by the factory-polynom related to the range limit of the calibrated range.

**7.4.3.4. Relative Span Gas Deviation**

Relative span gas deviation is the actual deviation minus the deviation of the previous calibration related to the range limit of the calibrated range.

**7.4.4. F4 Check Calibration**

There is a default calibration. Pressing F4, activates an automatic zero and span check for verification.

**7.4.4. F5 Reset Calibration Values**

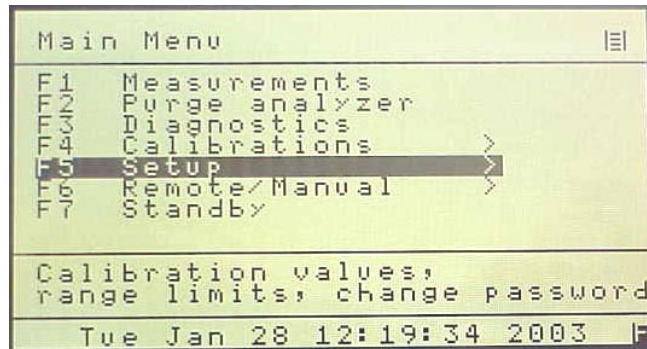
There is a default calibration. Pressing F5, a new screen appears and asks if the user is sure to reset calibration values to the default calibration values. F1 confirms and the calibration values are reset to default calibration values. F2 leaves this menu without resetting to default values. This function will overwrite all calibrations with factory values. Also the linearization polynom will be overwritten with the factory values.

**7.4.5. F6 Range Select**

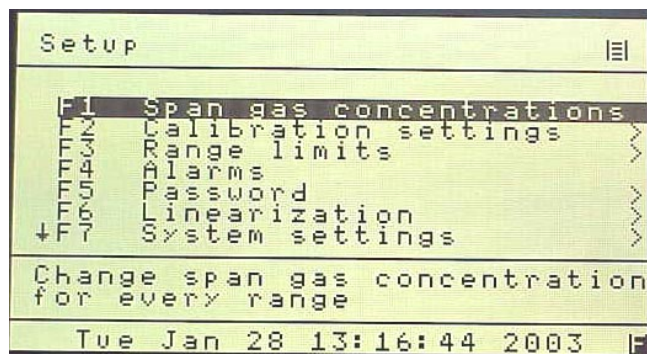
This allows a range change to be activated from the calibration menu.

### 7.5. F5 Setup

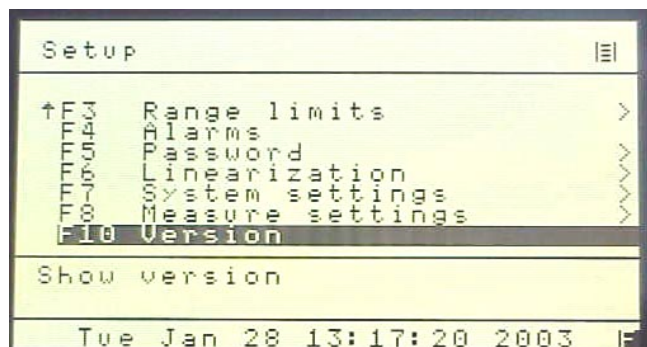
From the Main Menu, F5 brings up the setup menu. Span gas concentrations, calibration settings, range limits, alarms, password, linearization, system and measure settings can be changed. The Setup menu begins as shown below. A description of each parameter is shown in the information box. NOTE: Use the down arrow key to obtain the additional setup parameters.



Main Menu (User Level 4)



Setup Menu 1



Setup Menu 2

### 7.5.1. F1 Span Gas Concentration

For calibration, it is necessary to input the concentration of the span gas in ppm. For every range, the span gas concentration can be changed. After pressing F1 in the setup menu, a screen appears in which changes can be made. Select with the cursor buttons the range to change. The selected field turns black. To change parameters, switch to parameter input mode by pressing the Enter key. The input cursor (horizontal bar under the first character) then appears in the active edit field (black background). The cursor can be positioned with the right and left cursor keys, and the value displayed (number or letter) can be changed with the up and down cursor keys or entered directly. Every input has to be concluded by pressing the Enter key again. Then the input cursor disappears and a new range can be selected. The changes are saved by leaving the screen by pressing "Main" or "Back". At the right side of the screen, the range limits of the 4 ranges are displayed. They cannot be changed in this screen.

| Setup                       |          |      | ≡ |
|-----------------------------|----------|------|---|
| Span gas conc. range limits |          |      |   |
| Range1:                     | 25.200   | 30   |   |
| Range2:                     | 95.200   | 100  |   |
| Range3:                     | 265.100  | 300  |   |
| Range4:                     | 2925.700 | 3000 |   |

Change Span Gas Settings

### 7.5.2. F2 Calibration Settings

In the calibration settings menu, times, deviations and methods can be changed.

| Setup  |                      | ≡ |
|--|----------------------|---|
| F1   | Times                |   |
| F2   | Measuring deviations |   |
| F3   | Deviations           |   |
| F4   | Calib. via valves    |   |
| F5   | Calib. via probe     |   |
| Change purge-, measuring-,<br>verifying-, calibration time |                      |   |
| Wed Jan 29 11:08:11 2003                                   |                      |   |

Change Auto Calibration Settings

#### 7.5.2.1 F1 Times

There are four times (in seconds) for auto calibration that can be changed. Purge, measuring, calibration and verifying time. Changes are made and saved as above.



### 7.5.2.2 F2 Measuring Deviations

During auto calibration, the measured value is only saved if it is within a certain time within an upper and a lower limit. These two limits format a working window. In the setup menu the deviation is in percent.

### 7.5.2.3 F3 Deviations

Here you can change absolute and relative deviation in percent. After auto calibration, it is checked to assure the deviations are within this limit. If the deviations are not in this limit, a warning "Deviation error!" appears.

### 7.5.2.4 F4 Calibrations via Valves

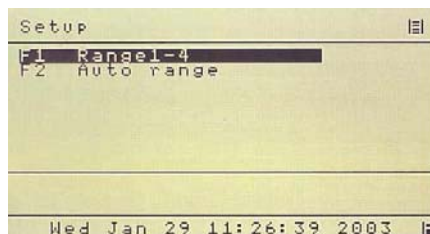
Calibrations can be made by using the solenoids for zero and span gas or by using the pump. Calibration via valves means that the zero gas is flown by the zero gas solenoid and the span gas is flown by the span gas solenoid.

### 7.5.2.5 F5 Calibration via Probe

Calibration via probe means that the zero and the sample gas is flown by the pump, the solenoids for zero and span gas are not used.

## 7.5.3. F3 Range Limits

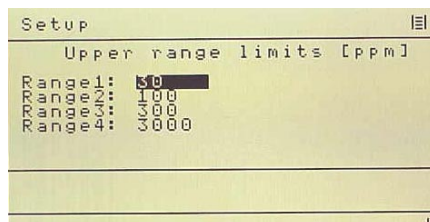
There are 4 different ranges. The user can define the upper range limits in ppm.



Change Range Limits

### 7.5.3.1 F1 Range 1-4 (Change Upper Range Limits)

In this menu the upper range limits can be changed. The new settings are saved by pressing MAIN or BACK. The auto range limits are automatically adapted. This means that if the upper range limit of range 1 for example has reached 90% of the upper range limit in the auto range mode, it is switched automatically to the second range.



Change Upper Range Limits

### 7.5.3.2 F2 Change Auto Range Limits

Although the auto range limits are adapted automatically, it is possible to define them manually. Up means the value when the next higher range is selected in auto range mode, down the value when the next lower range is selected.

| Setup   |      |     |       |
|---------|------|-----|-------|
|         | down | up  | [ppm] |
| Range1: |      | 27  |       |
| Range2: | 27   | 90  |       |
| Range3: | 90   | 270 |       |
| Range4: | 270  |     |       |

Change Auto Range Limits

### 7.5.4. F4 Alarms

Error reports are always displayed in the lowest line of the screen. There are two pressures, three temperatures, one concentration and two voltages with alarm limits that can be defined. The user can define the range limits and, if exceeded, will display an error-message.

| Alarms I                 |        |        |        |          |
|--------------------------|--------|--------|--------|----------|
| -Temps:                  | Cell : | Min    | Max    |          |
| [°C]                     | Diode: | 65.00  | 67.00  |          |
|                          | Conv.: | -5.50  | -4.50  |          |
|                          |        | 204.00 | 207.00 |          |
| F1 - next page           |        |        |        | page 1/2 |
| Tue Jan 28 14:10:36 2003 |        |        |        |          |

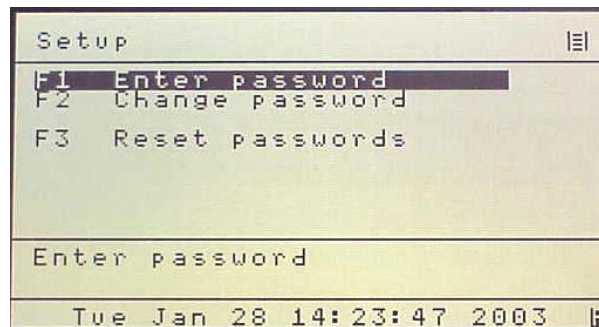
Set Temperature Alarms

| Alarms II            |        |       |       |          |
|----------------------|--------|-------|-------|----------|
| -Conc. alarms:       |        | Min   | Max   |          |
|                      |        | 500   | 750   |          |
| -Press:              | Sample | 3.82  | 3.88  |          |
| [PSIG]               | Air    | 14.00 | 16.00 |          |
| -EPC:                | Sample | 1.00  | 5.00  |          |
| [V]                  | Air    | 1.00  | 7.00  |          |
| F1 - previous page   |        |       |       | page 2/2 |
| Air Pressure Failure |        |       |       |          |

Set Concentration, Pressure and Voltage Alarms

### 7.5.5. F5 Password

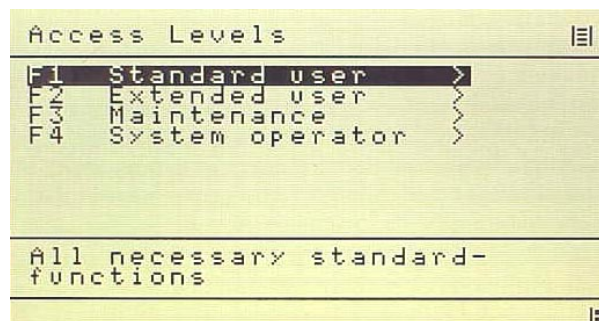
After turning on the analyzer, you are in access level 1. To change the access level or to change the passwords, press F5 (Setup) in the main menu and Press F5 (Password) again. The following screen appears:



Enter / Change Password

#### 7.5.5.1 F1 Enter Password

To change access level, press F1. The following screen appears:



Access Level Screen

F1 to F4 selects an access level. Move the cursor to the access level to be modified. You must enter the correct password for the access level desired. The passwords for the various operation levels consist of three numbers that must be entered on the numeric keypad. If the code word is incorrect, you are asked to re-enter the codeword.

**IMPORTANT TIP:** When a new analyzer is powered up, it defaults to access level 1 (User). To operate ALL parameters and gain complete access, select F4. Press the Enter key twice and enter 444.

#### 7.5.5.2 F2 Change Password

The passwords can only be changed, if you are in access level 4. After F2, enter your new 3 digit passwords.

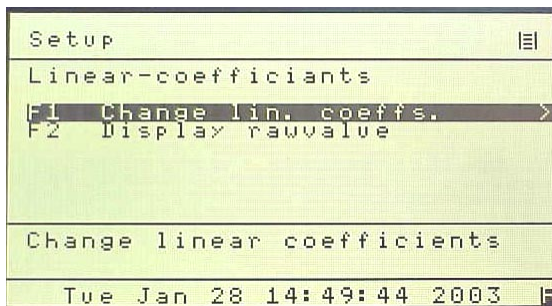
**IMPORTANT TIP:** You MUST remember and record this new password. If this is lost, you will need to consult the factory for the default password !!

**7.5.5.3 F3 Reset Passwords**

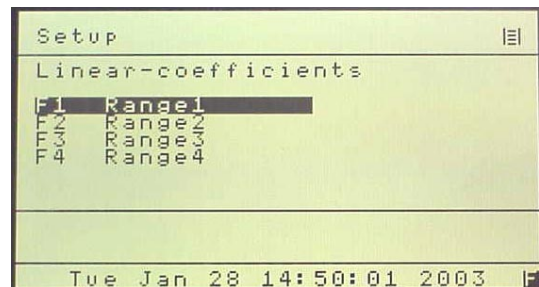
The passwords can only be changed, if you are in access level 4. Reset passwords will revert back to the factory defaults.

**7.5.6. F6 Linearization**

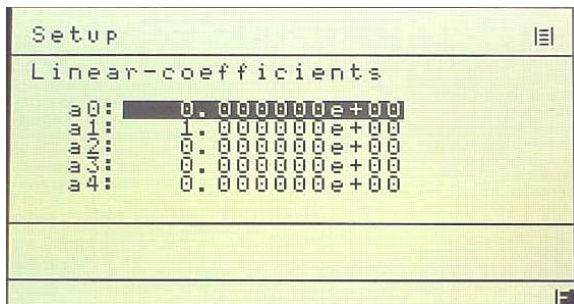
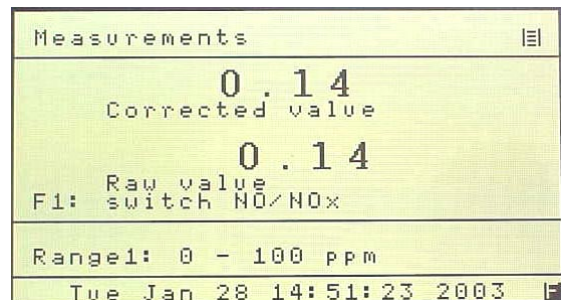
Pressing F6 on the Setup screen brings up the Linearization screen. The analyzer can be linearized by a polynomial with 5 coefficients. By pressing F1, these 5 coefficients can be changed for each range. By pressing F2, the raw value can be displayed. This is the value before linearization and offset span correction. There are two values on the screen: The value at the top is the linearized, offset-span-corrected value, and the other value is the raw-value.



Linearization Screen Linearization



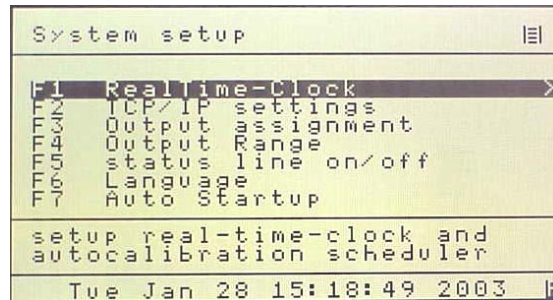
Coefficients Range Select

Change Linearization Coefficients  
of Selected RangeExample of Linearized and  
Raw Data with F2



### 7.5.7. F7 System Settings

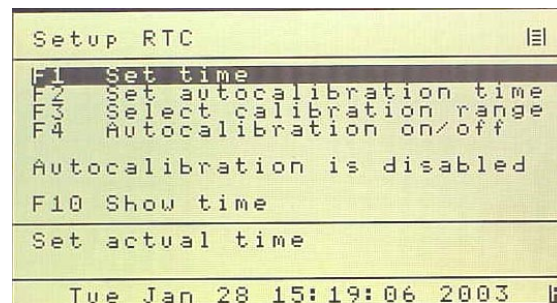
This screen allows all the system settings to be displayed and modified.



System Setup Screen

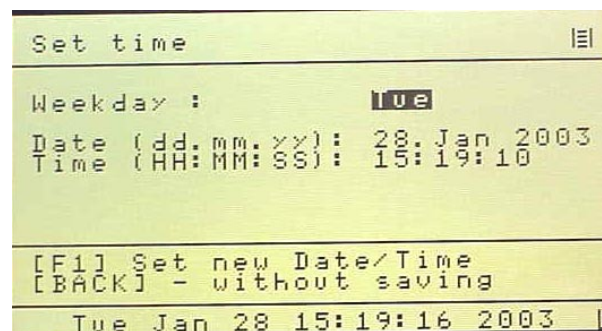
#### 7.5.7.1 F1 Real Time Clock

This brings up the clock time set screen, auto cal and auto cal enable screens.



Clock and Timing Setup Screen

F1 brings up the clock set screen



Set Clock Screen

The current time may be set by using the cursor to highlight the entry and using the numeric keys to change the values.

F2 brings up the auto cal time set. As above, the date and times can be set by using the cursor to highlight the entry and using the numeric keys to change the values. F3 Sets autocalibration ranges.

```

schedule                                     |
-----
Starttime : 16:00 on Tue
Date      : 28.Jan 2003
Every     : 1 hour(s).
F1 - change to weekly
F2 - change to daily
F3 - change to hourly
-----
press MAIN or BACK to exit
F1, F2, F3 to save changes
-----
Tue Jan 28 15:19:33 2003 |

```

#### Set Auto Cal Timing

```

Range selection                             |
-----
Enter Range [0..4]: 4
Converter Mode :
-----
If 0 all ranges will be
used for autocalibration
-----
Tue Jan 28 15:20:00 2003 |

```

#### Set Auto Cal Ranges

```

Setup RTC                                  |
-----
F1 Set time
F2 Set autocalibration time
F3 Select calibration range
F4 Autocalibration on/off
-----
Autocalibration is disabled
F10 Show time
-----
enable/disable
autocalibration
-----
Air Pressure Failure |

```

F4 Toggles Auto Cal ON of OFF.

**7.5.7.2 F2 Displays TCP/IP Address**

| TCP/IP setup                  |                 |
|-------------------------------|-----------------|
| IP-address:                   | 192.000.000.229 |
| Netmask :                     | 255.255.255.000 |
| Port :                        | 7700            |
| WinIfPort:                    | 2000            |
| HWaddress : 00.E0.4B.01.9D.D4 |                 |
| enter IP-Address              |                 |
| take effect after reboot      |                 |
| Tue Jan 28 15:48:23 2003      |                 |

TCP/IP Address

**7.5.7.3 F3 Displays Output Signal Assignments***(Used to Adjust Analog Output Channels)*

| assignment           |          |               |
|----------------------|----------|---------------|
| Output               | Signal   | Error on AOut |
| 1                    | Realtime | Off           |
| 2                    | off      |               |
| 3                    | off      |               |
| 4                    | off      |               |
| Air Pressure Failure |          |               |

Output Assignments

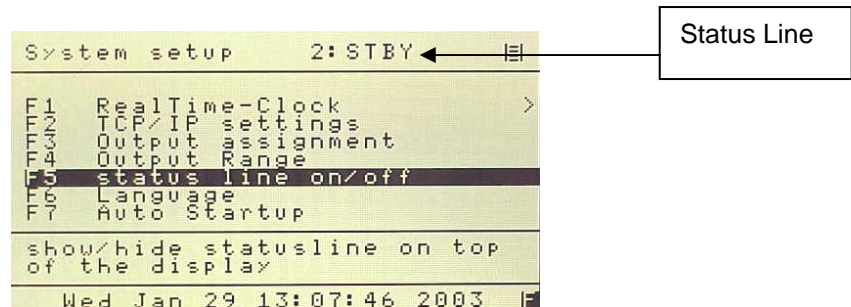
**7.5.7.4 F4 Displays Output Ranges***(Used to Adjust Scale of Analog Output Channels)*

| output ranges                                    |       |             |      |
|--|-------|-------------|------|
| Output   | lower | Limit upper | Mode |
| 1  | 0     | 0           | V    |
| 2  | 0     | 0           | V    |
| 3  | 0     | 0           | mA   |
| 4  | 0     | 0           | mA   |
| enter 0 in both fields to use the default range. |       |             |      |
| Air Pressure Failure                             |       |             |      |

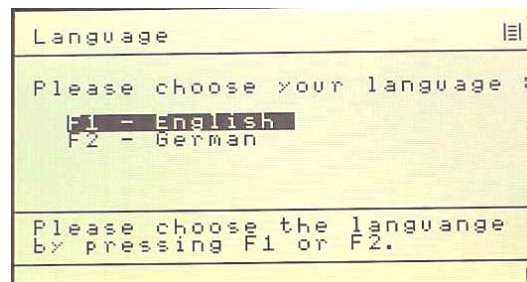
Output Ranges

#### 7.5.7.5 F5 Turns Status Line On or Off

The status line displays the AK Protocol action on the top line of the display.



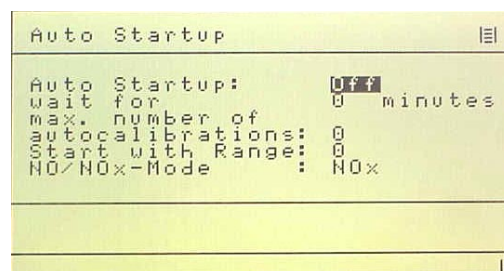
#### 7.5.7.6 F6 Language



Select Language

#### 7.5.7.7 F7 Automatic Setup

This screen brings up the automatic startup parameters. If activated, the analyzer will automatically start up the autocalibration cycle upon power on. The function is toggled on and off with the Enter key. The cycle timing, number of cals, range and NO/Nox mode may be set. After calibration, the analyzer enters the sample mode and outputs a digital signal. This is very useful in unattended applications.

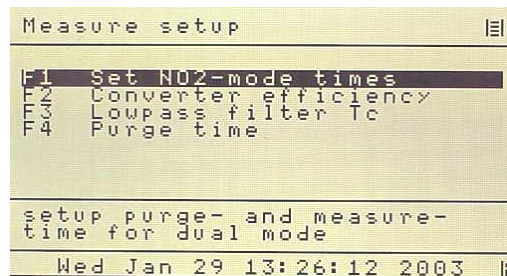


Automatic Startup Parameters



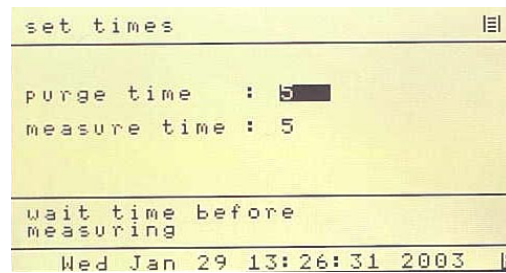
### 7.5.8. F8 Measure Settings

This screen allows several of the system settings to be displayed and modified.



Menu Settings Screen

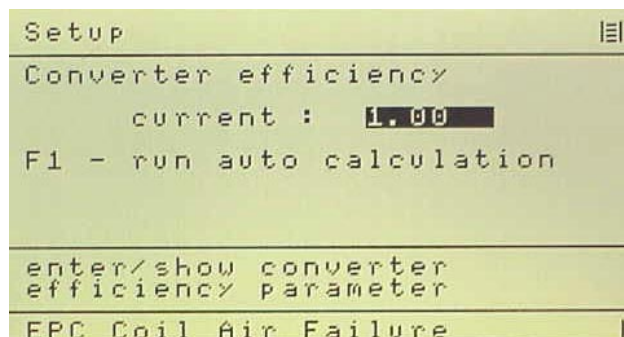
#### 7.5.8.1 F1 Set NO2 Mode Times



Set NO2 Purge and Measure Time

#### 7.5.8.2 F2 Converter Efficiency

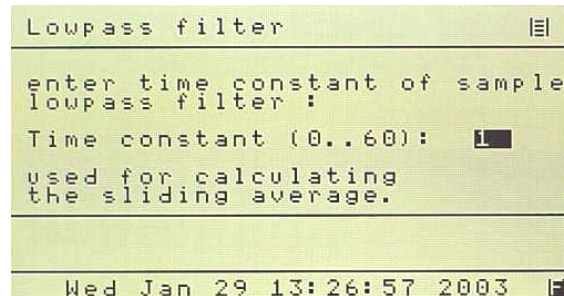
F2 on the Menu Settings screen allows the NO to NO2 converter efficiency to be set to the actual measured converter efficiency. A value of 100% equals 1.00. F2 will prompt the operator through the NOx efficiency test using a NOx generator.



Set Converter Efficiency

### 7.5.8.3 F3 Low Pass Filter Time Constant

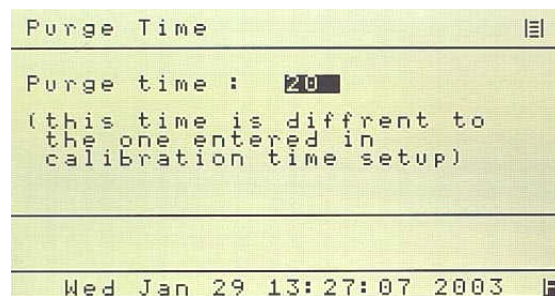
F3 on the Menu Settings screen allows the software time constant to be set between 1 and 60 seconds. This is very useful in eliminating noise when measuring low level concentrations.



Set Time Constant

### 7.5.8.4 F4 Purge Time

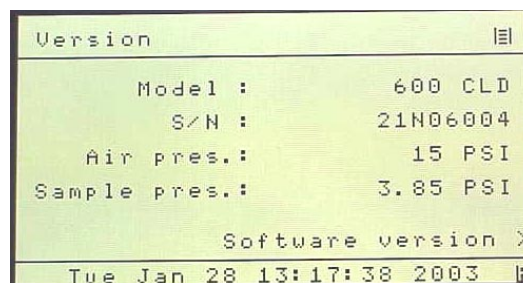
F4 on the Menu Settings screen sets the purge time before continuing with a zero or span calibration.



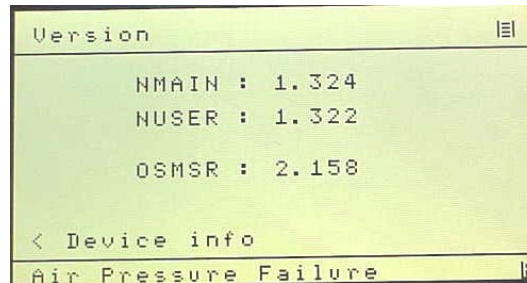
Set Purge Time

### 7.5.10. F10 Displays the Current Analyzer and Software Versions

This displays the analyzer's information, including the factory recommended air and sample pressure settings.



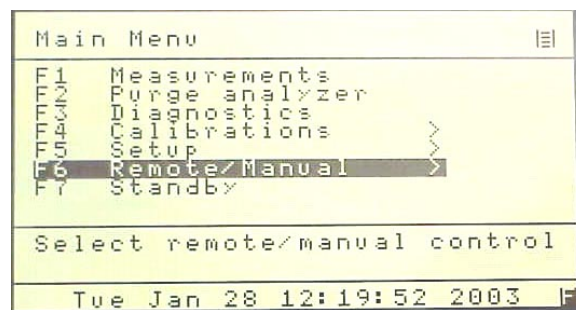
Analyzer Information Version



Software Version

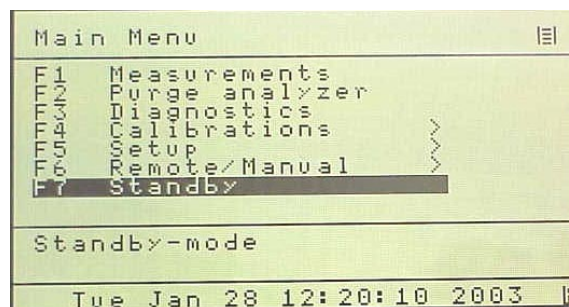
### 7.6. F7 Remote / Manual Control

The analyzer can be remote-controlled by either a master computer or via contact closures. The TCP/IP and serial communication fully corresponds to the specifications of the AK protocol. To change remote/manual control, press F6 in the main menu. This toggles between remote and manual control.



Main Menu (User Level 4)

### 7.7. F8 Standby



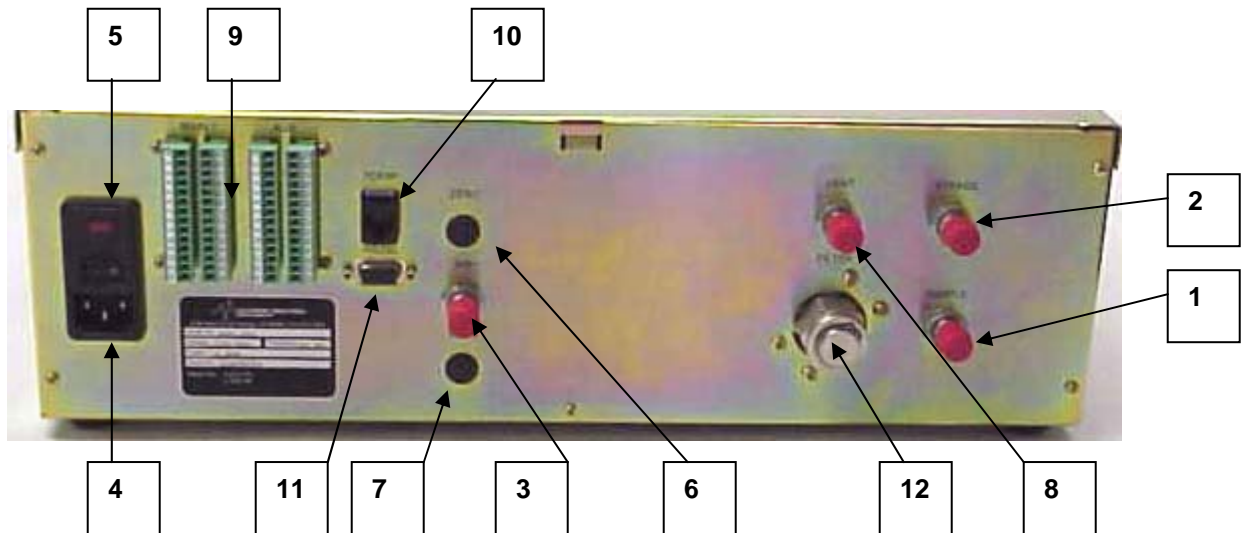
Main Menu (User Level 4)

In Standby mode, pump is turned off and the solenoids are closed. The Siemens logo is displayed.

## 8. Analyzer Components

### 8.1. Rear Panel

The following details the rear panel connections:



**Figure 32: Rear Panel**

1. **Sample Gas Inlet:** Feeds sample gas to the analyzer. ¼ Inch Tube.
2. **Sample Gas Bypass Outlet (Vent):** Exhaust for sample. ¼ Inch Tube.
3. **Ozone Air Inlet:** For feeding hydrocarbon free air or oxygen to the ozone generator.
4. **Power Entry Module:** Power connection, power switch, fuse compartment (2 Amp).
5. **Rear Panel Power ON/OFF Switch:** Turns ON/OFF line power to instrument.
6. **Zero Gas Inlet:** For feeding hydrocarbon free zero air to the analyzer.
7. **Span Gas Inlet:** For feeding calibration gas to the analyzer.
8. **Vent:** Exhaust from reaction chamber, ¼ inch tube fitting.
9. **Output Connectors:** Analog Outputs and Remote Functions.
10. **TCP/IP Connection:** Connect Network Connector.
11. **Serial Connector:** Connect Serial Connector
12. **Filter:** Analyzer Filter Housing

**8.1.1. Main Connector (Standard 28 Pin Connector)**

| <u>Pin</u> | <u>Signal</u>  | <u>Function</u>  | <u>Pin</u> | <u>Signal</u>  | <u>Function</u> |
|------------|----------------|------------------|------------|----------------|-----------------|
| 1          | Analog Output  | Ground (Analog)  | 15         | Digital Input  | Control Range 3 |
| 2          | Analog Output  | Realtime         | 16         | Digital Input  | Control Range 4 |
| 3          | Analog Output  | NO               | 17         | Digital Input  | Auto Cal        |
| 4          | Analog Output  | NOx              | 18         | Digital Input  | Calibrate       |
| 5          | Analog Output  | NO2              | 19         | Digital Input  | Zero            |
| 6          | Digital Output | Ground (Digital) | 20         | Digital Input  | Span            |
| 7          | Digital Output | Sense AutoRange  | 21         | Digital Input  | Pump            |
| 8          | Digital Output | Sense Range 1    | 22         | Digital Input  | Zero Gas Flow   |
| 9          | Digital Output | Sense Range 2    | 23         | Digital Output | Span Gas Flow   |
| 10         | Digital Output | Sense Range 3    | 24         | Digital Output | Sample Gas Flow |
| 11         | Digital Output | Sense Range 4    | 25         | Digital Output | Local/Remote    |
| 12         | Digital Input  | Set Auto Range   | 26         | Digital Output | Read Cal Mode   |
| 13         | Digital Input  | Control Range 1  | 27         | Digital Output | Reserved        |
| 14         | Digital Input  | Control Range 2  | 28         | Digital Output | Reserved        |

**8.1.2. Auxiliary Connector (Standard 28 Pin Connector)**

| <u>Pin</u> | <u>Signal</u>  | <u>Function</u>   | <u>Pin</u> | <u>Signal</u>  | <u>Function</u>   |
|------------|----------------|-------------------|------------|----------------|-------------------|
| 1          | Analog Input   | Ground            | 15         | Digital Output | Ground (Alarm)    |
| 2          | Analog Input   | External Analog 1 | 16         | Digital Output | Calibrate Alarm 1 |
| 3          | Analog Input   | External Analog 2 | 17         | Digital Output | Reserved          |
| 4          | Analog Input   | Spare Analog      | 18         | Digital Output | Reserved          |
| 5          | Analog Input   | Spare Analog      | 19         | Digital Output | Reserved          |
| 6          | Digital Output | Ground (Alarm)    | 20         | Digital Output | Read Wet Mode     |
| 7          | Digital Output | General Alarm     | 21         | Digital Output | Read Overflow     |
| 8          | Digital Output | Ch 1 Conc Alarm   | 22         | Digital Output | Read NO Mode      |
| 9          | Digital Output | Ch 2 Conc Alarm   | 23         | Digital Input  | Set Wet Mode      |
| 10         | Digital Output | Reserved          | 24         | Digital Input  | Set Overflow Mode |
| 11         | Digital Output | Reserved          | 25         | Digital Input  | Set NO Mode       |
| 12         | Digital Input  | Reserved          | 26         | DI/DO          | Spare             |
| 13         | Digital Input  | Reserved          | 27         | DI/DO          | Spare             |
| 14         | Digital Input  | Reserved          | 28         | DI/DO          | Spare             |

**8.1.3. Digital Outputs – RS-232 (Standard 9 Pin DIN Connector)**

| <u>Pin</u> | <u>Function</u>         |
|------------|-------------------------|
| 1          | DCD Carrier Detect      |
| 2          | RxD Receive Data        |
| 3          | TxD Transmit Data       |
| 4          | DTR Data Terminal Ready |
| 5          | Ground                  |
| 6          | DSR Data Set Ready      |
| 7          | RTS Ready to Send       |
| 8          | CTS Clear to Send       |
| 9          | RI Ring Indicator       |

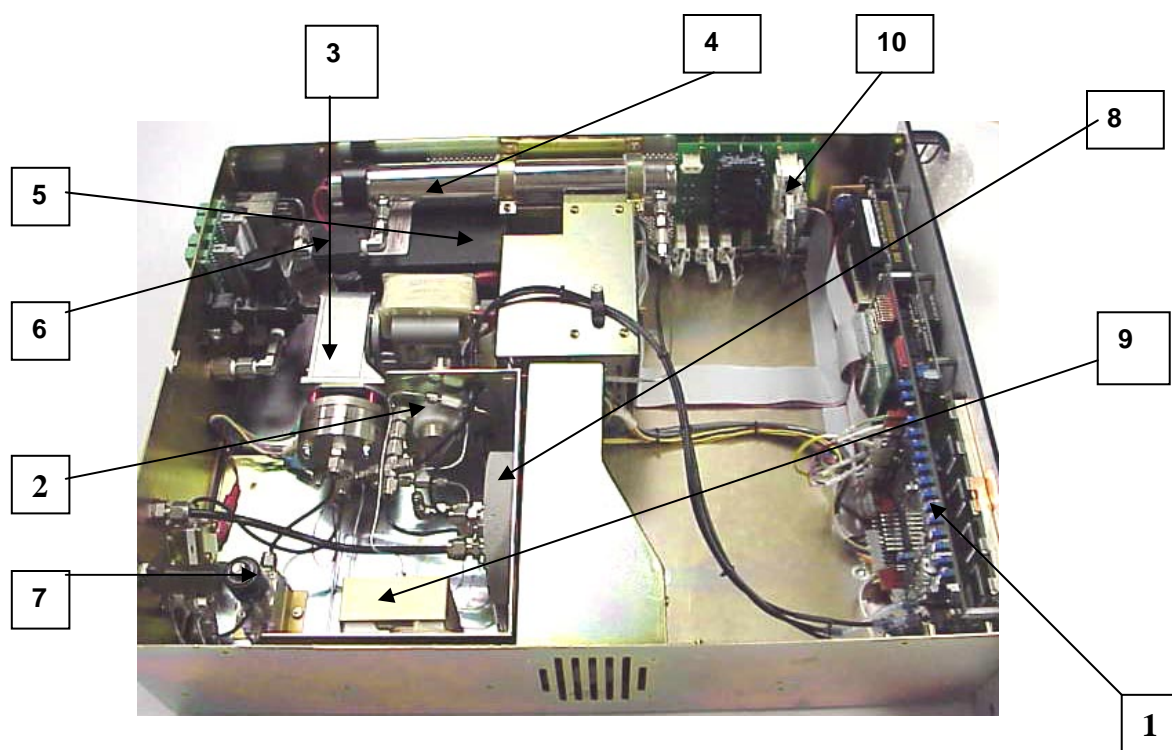
**8.1.4. Digital Outputs – TCP/IP (8 Pin RJ-47 Connector)**

| <u>Pin</u> | <u>Function</u> |
|------------|-----------------|
| 1          | TDX+            |
| 2          | TDX-            |
| 3          | RXD+            |
| 4          | Open            |
| 5          | Open            |
| 6          | RXD-            |
| 7          | LNLED           |
| 8          | LNLED           |

**IMPORTANT TIP:** For direct connect to a PC a crossover cable is required.  
Connection to a hub requires a straight cable.



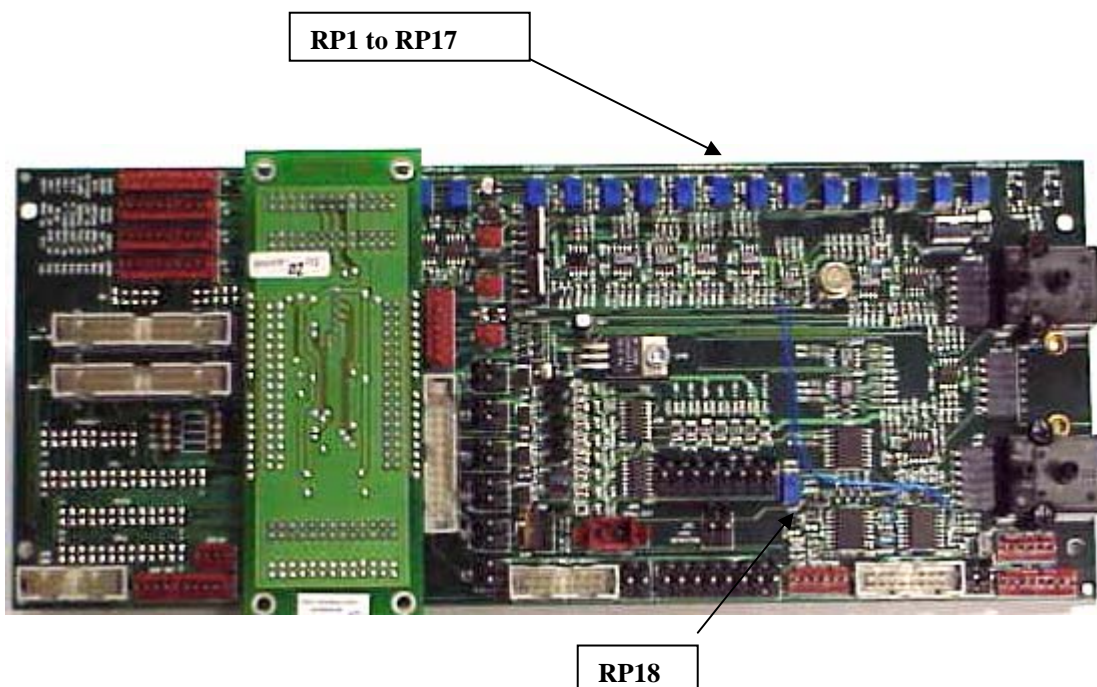
### 8.2. Internal Component Locations



Major Internal Components

1. **Electronics:** Includes instrument electronics. (See Main Electronic Board)
2. **NO/NO<sub>x</sub> Solenoid Valve:** Switches flow between the NO and NO<sub>x</sub> mode.
3. **Optional Internal Sample Pump:** Provides sample to analyzer.
4. **Ozonator:** Contains UV Lamp.
5. **Ozonator High Voltage Supply:** Produces High Voltage to UV lamp.
6. **Proportional Flow Pressure Regulator:** Regulates flow of ozone.
7. **Proportional Flow Pressure Regulator:** Regulates flow of sample.
9. **Reaction Chamber & Detector Assembly:** See Figure 8.
10. **NO/NO<sub>x</sub> Converter:** Converts NO<sub>2</sub> to NO for total NO<sub>x</sub>
11. **Relay Control Board:** Provides AC Voltage to Heaters, Pump and UV Transformer.

### 8.3. Main Electronics Board (Potentiometers)

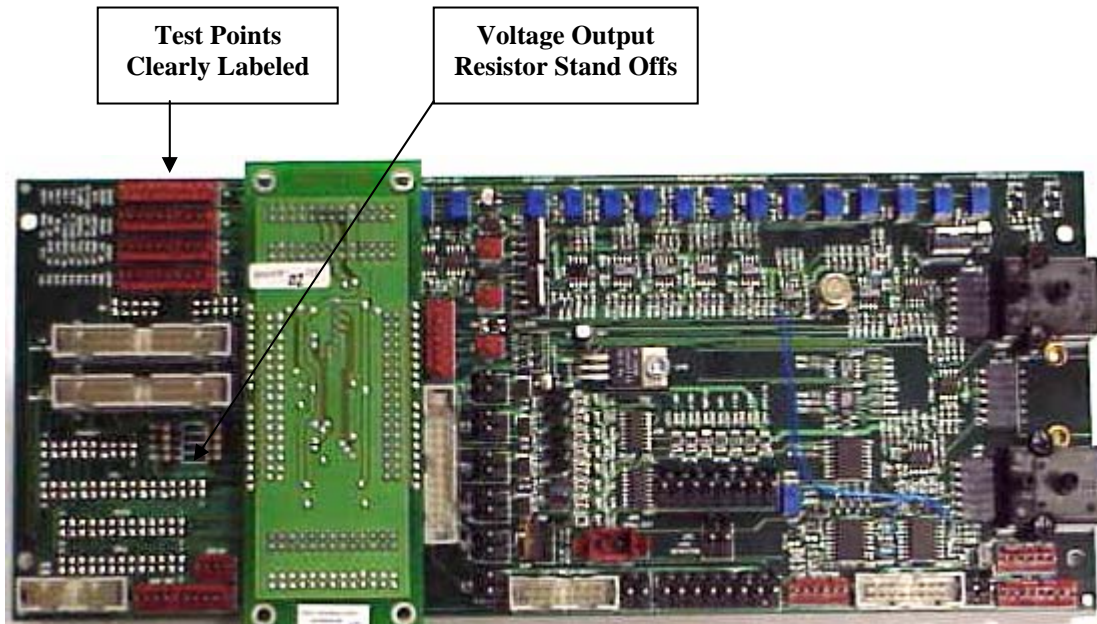


Main Electronic Board Potentiometers

|            |                       |             |                         |
|------------|-----------------------|-------------|-------------------------|
| <b>RP1</b> | : EPC 9.5V Sample Set | <b>RP10</b> | : Chiller Zero Temp Set |
| <b>RP2</b> | : EPC 9.5V Air Set    | <b>RP11</b> | : Chiller Span Temp Set |
| <b>RP3</b> | : O3 Cutoff           | <b>RP12</b> | : Chiller Temp Set      |
| <b>RP4</b> | : Cell Temp Set       | <b>RP13</b> | : 12VDC Adjust          |
| <b>RP5</b> | : Oven Temp Set       | <b>RP14</b> | : Sample Pressure Set   |
| <b>RP6</b> | : Pump Temp Set       | <b>RP15</b> | : Air Pressure Set      |
| <b>RP7</b> | : Converter Temp Set  | <b>RP16</b> | : Not Used              |
| <b>RP8</b> | : O2 Temp Set         | <b>RP17</b> | : Not Used              |
| <b>RP9</b> | : NH3 Temp Set        | <b>RP18</b> | : Coarse Zero Adjust    |

**NOTE:** Potentiometers are clearly labeled on both sides of the PCB.



**8.4. Main Electronics Board (Connectors)**

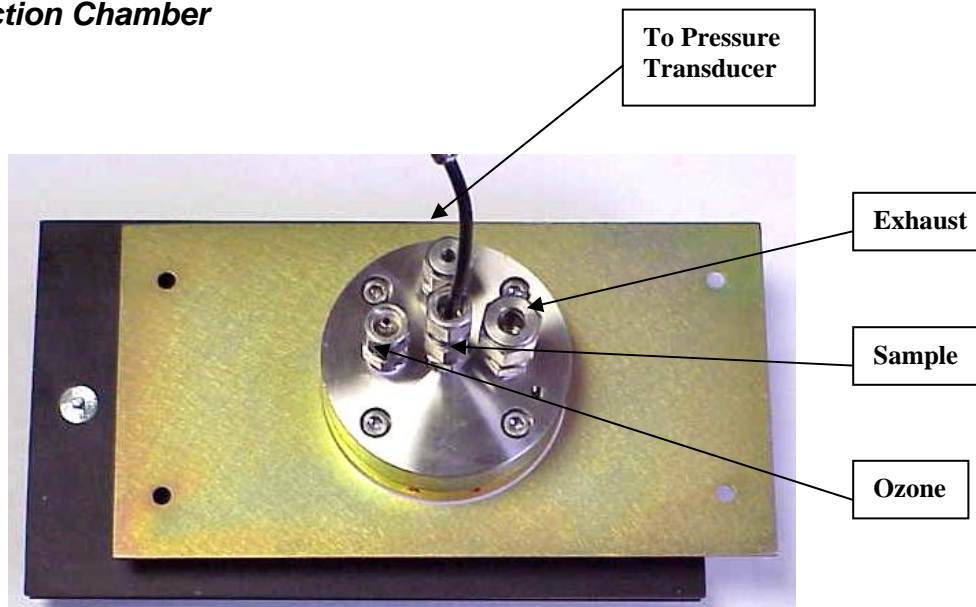
Main Electronic Board Connectors

|                                    |   |
|------------------------------------|---|
| <b>J1</b> : Test Points            | <b>J2</b> : Test Points                       |
| <b>J3</b> : Test Points            | <b>J4</b> : EPC Air Valve                     |
| <b>J5</b> : Test Points            | <b>J6</b> : Digital Output 2 (DIDO Board)     |
| <b>J7</b> : EPC Sample             | <b>J8</b> : Sample Transducer                 |
| <b>J9</b> : Aux Back Panel         | <b>J10</b> : Spare Digital Output             |
| <b>J11</b> : Diluter               | <b>J12</b> : Main Back Panel                  |
| <b>J13</b> : Digital Input 2       | <b>J14</b> : NO/NOx Valve                     |
| <b>J15</b> : Diluter Transducer    | <b>J16</b> : Span Valve                       |
| <b>J17</b> : Digital Output 1      | <b>J18</b> : Zero                             |
| <b>J19</b> : Aux Power             | <b>J20</b> : Air Transducer                   |
| <b>J21</b> : Sample Overflow Valve | <b>J22</b> : Daisy Chain Input 1 (DIDO Board) |
| <b>J23</b> : Wet/Dry Valve         | <b>J24</b> : Chiller Out                      |
| <b>J25</b> : + 5 Volt Detector     | <b>J26</b> : Spare Analog Input               |
| <b>J27</b> : Chiller Temp Sense    | <b>J28</b> : Spare Back Panel                 |
| <b>J29</b> : Spare Digital Input   | <b>J30</b> : Daisy Chain Output (DIDO Board)  |
| <b>J31</b> : Fan Power             | <b>J32</b> : Relay Board                      |
| <b>J33</b> : Chiller Power         | <b>J34</b> : Power                            |
| <b>J35</b> : Detector              | <b>J36</b> : O2 Detector                      |
| <b>J37</b> : Thermocouple          | <b>J38</b> : RTD                              |
| <b>JP1</b> : PGA Zero              |   |

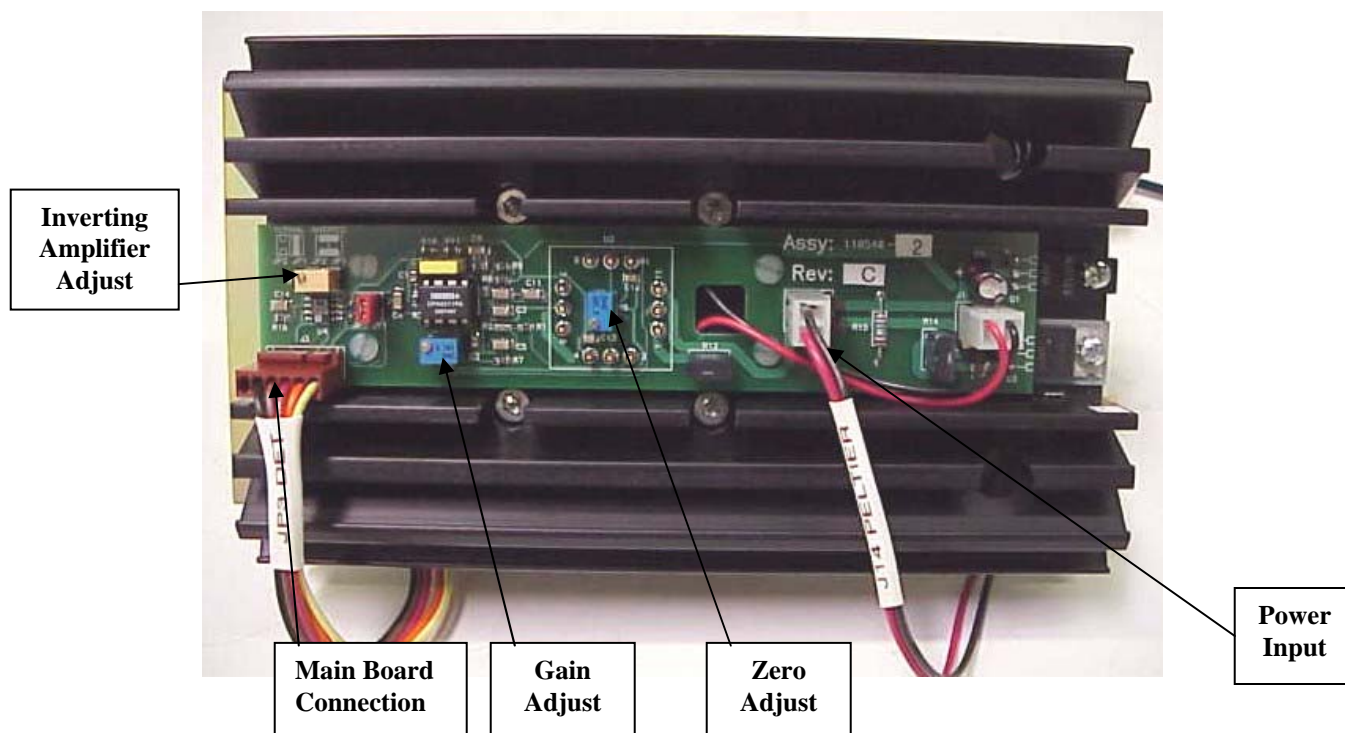
**NOTE:** Connections are clearly labeled on the PCB

--

### 8.5. Reaction Chamber

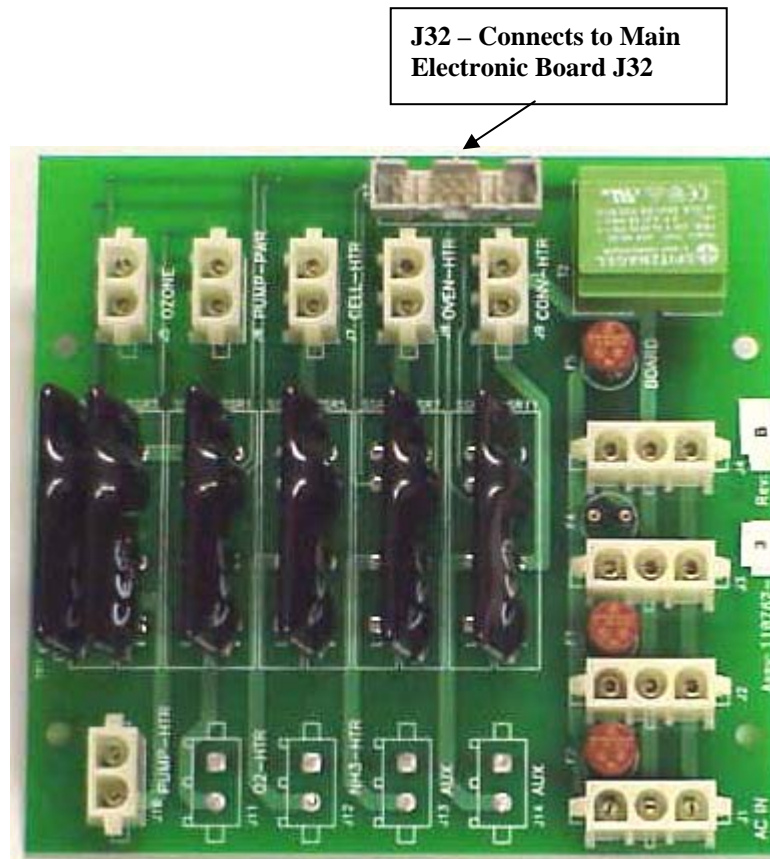


Reaction Chamber Assembly (Oven Side)



Reaction Chamber Pre-Amplifier

### 8.6. Relay Board Connections



#### Relay Board Connections

|                                   |                                  |
|-----------------------------------|----------------------------------|
| <b>J1</b> : AC Input              | <b>J2</b> : Power Supply 1       |
| <b>J3</b> : <b>Power Supply 2</b> | <b>J4</b> : Power Supply 3       |
| <b>J5</b> : Ozone Lamp            | <b>J6</b> : Pump Power           |
| <b>J7</b> : Cell Heater           | <b>J8</b> : Oven Heater          |
| <b>J9</b> : Converter Heater      | <b>J10</b> : Pump Heater         |
| <b>J11</b> : Optional O2 Heater   | <b>J12</b> : Optional NH3 Heater |
| <b>J13</b> : Aux                  | <b>J14</b> : Aux                 |

## 9. Operation

### 9.1. Preparation for Operation

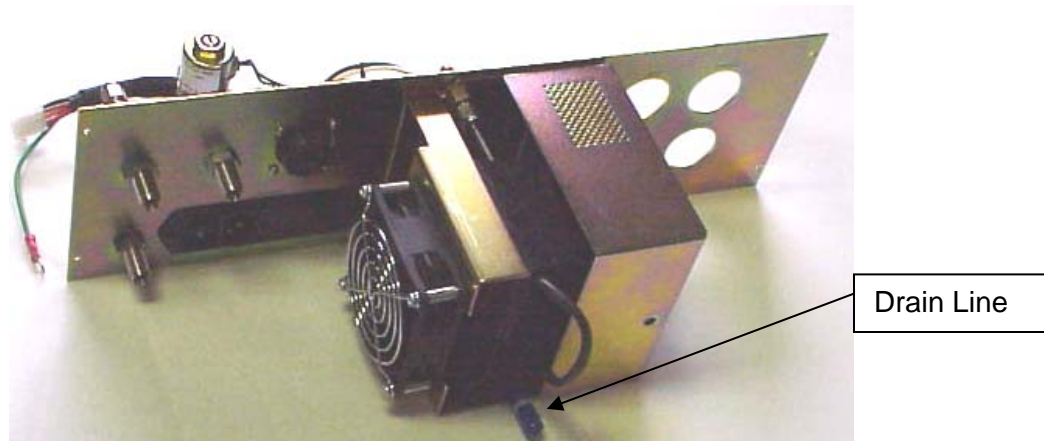
Check that the external plumbing and wiring have been connected correctly, as described in this manual.

**NOTE:** The internal ozone generator requires approximately 1 hour of continuous operation for the analyzer to achieve full zero and span calibration stability. A pressure switch will turn off the ozonator when air or oxygen is not present at the analyzer rear panel.

### 9.2. Operation

1. **Power On:** Turn ON the power switch on the rear panel. The digital display should illuminate.
2. **Introduce Ozone Supply (Air or O<sub>2</sub>):** Adjust the cylinder output pressure to 25 PSIG. The internal air pressure is factory set to deliver the air pressure required for optimum analyzer performance as indicated in the factory settings screen.
3. **Air or O<sub>2</sub> Pressure Settings:** Check the air pressure setting by referring to the diagnostic screen to check air pressure. The pressure should read as indicated in the factory settings screen.
4. **Zero Adjustment:** Flow zero gas through the instrument by selecting the calibration screen and select either manual or auto calibrate. **NOTE:** The instrument may also be operated by an external computer or by remote contact closures.
5. **Span Adjustment:** Flow span gas through the instrument by selecting the calibration screen and select either manual or auto calibrate. **NOTE:** The instrument may also be operated by an external computer or by remote contact closures. **NOTE:** The correct calibration gas values must be entered. The instrument is available from the factory with four ranges.
6. **NO/NO<sub>x</sub> Function:** The analyzer switches the NO<sub>x</sub> converter in and out of the sample stream and is controlled from the measurement screen. In the NO mode, the sample by-passes the converter and the resultant analysis produces the value of NO (Only) in the sample. In the NO<sub>x</sub> mode, the sample passes through converter and the resultant analysis produces the value of NO<sub>x</sub> (NO + NO<sub>2</sub>) in the sample. The NO mode may be switched in and out remotely by a contact closure or computer. Remote control wiring is terminated in the rear panel connector. (See Appendix).

7. **Sample Pressure Check:** With sample gas flowing through the instrument, check the sample pressure setting by referring to the diagnostic screen. The sample pressure should read as indicated in the factory pressure settings screen.
8. **Optional Rear Mounted After NO<sub>x</sub> Converter Chiller:** With gas flowing through the instrument at 85 to 100 degrees C, the sample is passed through the heated NO<sub>2</sub> to NO converter, the rear mounted chiller and to the reaction chamber. This allows for a dry measurement.



This chiller is self-contained and has a single temperature adjust potentiometer which is accessible through the electronics cover. The chiller has a ¼ inch drain, which **MUST** be held at a “bleed” pressure, either through an external peristaltic pump or needle valve. Drain flow rate of 10 ml/min should be sent to facility drain. An optional Wet/Dry switch is available.

**CAUTION:** Never supply a “wet” sample to a cold analyzer as damage may occur.

9. **Sample Pump:** If the analyzer is supplied with the optional internal heated sample pump, it is always on in the measure mode. It is turned off during calibration and may be manually turned off by putting the analyzer in standby.
10. **Heated Sample Line:** Make certain the heated sample line is up to temperature and flushed before connecting to the analyzer sample inlet.
11. **Instrument Power:** Turn instrument power on and allow the oven temperature to stabilize before turning on the sample pump and/or connecting the heated sample line.



12. **Sampling System:** Prepare and check the sample system. Check the sample pressure as indicated in the factory settings screen.
13. **Air or O<sub>2</sub> Pressure:** Check the Air/O<sub>2</sub> pressure for proper setting as indicated in the factory setting screen. Readjust internal pressure as required. Note: Cylinder pressure should be set at 25 PSIG.
14. **Zero & Span Calibration:** Zero and span adjustment should be checked every 24 hours by either manual or automatic calibrations.
15. **Reaction Chamber Assembly:** Dust, water droplets, or mist entering the reaction chamber assembly may cause drift due to contamination. If the calibration procedures fails to bring the instrument to zero, check the chamber for contamination.

### **9.3. Shut Down Procedure**

1. Turn off the zero, span and air/O<sub>2</sub> cylinders.
2. If the analyzer contains the optional internal heated sample pump, disconnect the sample line from the rear inlet port. Do **NOT** turn off the sample pump or analyzer power at this point.
3. Allow the analyzer to draw in room air for approximately 5 minutes. This will flush out any remaining sample which may cause condensation as the analyzer cools.
4. Turn off the pump switch.
5. Turn off the optional internal sample pump by setting the analyzer to standby.
6. Back-flush the heated sample line (and filter) of any sample before disconnecting and powering down.

## **10. Functional Description**

### ***10.1. Operating Principle***

The Siemens NOXMAT Analyzer utilizes the chemiluminescent method of determination of oxides of nitrogen (NO or NO<sub>x</sub>) in a sample gas. In the NO mode, the NO in the sample is quantitatively converted to NO<sub>2</sub> by gas phase oxidation with molecular ozone produced by the UV reaction of cylinder air. Generally, 10 to 15 percent of these NO<sub>2</sub> molecules are elevated to an electronically-excited state. This reaction is immediately followed by reversion to a non-excited state and emission of photons. The photons impinge on a photodiode detector (PHOTODIODE) which generates a low DC current directly proportional to the NO contained in the sample gas. This current is amplified by a precision electrometer and presented to digital panel meter and recorder output. In the NO<sub>x</sub> mode, the sample is first routed to the NO<sub>x</sub> converter where the NO<sub>2</sub> component is reduced to NO. The complete sample is analyzed by the PHOTODIODE as above. The instrument contains heated sections which keep the sample at approximately 100 degrees C prior to the reaction chamber. All temperatures are measured by N.I.S.T. traceable standards.

### ***10.2. Reaction Chamber***

The sample and ozone are delivered to the reaction chamber via the unique regulated flow system described below. The sample and ozone are mixed together at the center of the chamber where the reaction takes place. The sample is vented from the chamber through a 1/8 inch stainless steel tube. The chamber contains a red filter which is sealed with an integral O Ring. The chamber assembly is O Ring mounted to the PHOTODIODE. The complete chamber and PHOTODIODE assembly is housed in an RFI shielded enclosure.

### ***10.3. Flow System***

The basic function is to deliver highly regulated flows of sample and air or O<sub>2</sub> to the ozonator and reaction chamber assemblies. An EPC valve delivers air at approximately 15 PSIG to a pre-set capillary and consequently accurately predetermines the ozone flow rate. The air supply cylinder should be set to 25 psig. The sample is presented to the reaction chamber via a precision, factory set electronically controlled proportional pressure valve through a capillary. This pressure is factory set at approximately 3.85 PSIG. A close coupled by-pass capillary minimizes "dead volume" and improves response time. Sample inlet pressure and regulated air pressures are monitored by internal pressure transducers and presented in PSIG via the diagnostics screen. NOTE: The correct pressures are determined by the factory for optimum analyzer performance and measured by N.I.S.T. traceable standards. They are recorded on the Factory Settings Screen.

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***10.4. Main Electronics Board***

The main electronics board contains the instrument power supplies and required instrument electronics. A single transformer provides power to the main circuit board and includes provisions for 110/220 VAC at 50/60 Hz input.

***10.5. Relay Board***

The relay circuit board contains the logic circuitry required to control and switch the AC power to the required heaters and sample pump.



## 11. Reaction Chamber

### ***11.1. Disassembly Procedure***

- a. Shut off ALL gas flow.
- b. Remove power from the instrument.
- c. Remove the top cover retaining screws.
- d. Remove all 4 tubes from the 4 way cross.
- e. Remove the 4 screws securing the photodiode and reaction chamber from the oven.
- f. Remove the photodiode electrical connector from the main circuit board.
- g. Remove the chiller connection from the photodiode/reaction chamber.
- h. Separate the photodiode and heat sink assembly from the reaction chamber by removing the 4 Allen screws from the front of the heat sink. Save the 2 black rubber "O" rings.
- i. Separate the mounting plate and the glass filter from the reaction chamber. Save the 2 Teflon spacers and "O" ring.
- j. Separate the manifold from the gold reaction chamber. NOTE the position of the holes in the Teflon gasket relative to the assembly screw holes. The large hole is ozone.

### ***11.2. Assembly Procedure***

- a. Wash the reaction chamber glass filter and manifold separately in detergent using a test tube brush. Be careful of the sample tube in the manifold. Do not use abrasives.
- b. Dry by blowing clean with dry nitrogen.
- c. Reassemble the chamber assembly in reverse order per the above. Make certain the sample tube is centered when assembling the manifold to the reaction chamber.

## 12. Troubleshooting

### **12.1. Ozone Air/O<sub>2</sub> Supply**

The Air/O<sub>2</sub> flow is controlled by an EPC valve. It requires 25 psig cylinder supply pressure and is factory set to deliver approximately 10 to 20 psig to the ozone capillary. This pressure may be monitored by the diagnostics meter. The flow rate from the capillary is very low and will require a bubble flow meter to accurately determine proper flow.

### **12.2. Sample Supply**

The sample flow is controlled by an adjustable electronic proportional pressure valve. This valve requires a 10 to 25 PSIG sample supply pressure to deliver the proper pressure to the sample capillary. This pressure may be monitored by the diagnostics meter at any time after inlet sample has been applied. The sample flow rate from the capillary is very low and will require a bubble flow meter to determine proper flow rate. If the pressure is properly set, and a clogged capillary is suspected, replace the sample capillary.

**NOTE:** If the analyzer contains an optional internal sample pump, the introduction of a pressurized sample gas in excess of 1.5 PSIG will damage the pump.

### **12.3. NO/NO<sub>x</sub> Converter**

Several published test procedures require periodic NO<sub>x</sub> efficiency tests to be performed on the converter to determine NO<sub>2</sub> to NO conversion efficiency utilizing a NO<sub>x</sub> generator. The Siemens Model NO<sub>x</sub>Gen may be used for this procedure. A short test using NO<sub>2</sub> calibration gas is also defined in the U.S Federal Register, Title 40, Part 86.332.79 (e).

## **13. Drawings**

### ***13.1. AK Protocol***

### ***13.2. Rear Panel Connections***

### ***13.3. Flow Diagrams***

### ***13.4. Block Electrical Drawing***

### 13.1 Serial Interface and AK-Commands

The serial interface enables remote control of the Model 600 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:

Pin 3 = Txd (transmit)  
Pin 2 = Rxd (receive)  
Pin 5 = Gnd (ground)

#### Interface Parameters

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

#### 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 (1 to 9).
- 2) If the transfer was faulty or the function code unknown, the answer contains four question marks (example. "???? 0").
- 3) If the displayed value is not valid, a "#" is placed in front of the measured value (example: "AIKG 0 #9999").
- 4) If a control or adjusting command is sent via the serial interface while the measuring 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 e.g. "ATEM 0 3 NA" in which 3 is the number of the sub-channel.
- 6) If the device is busy with a running function (SLIN, for example), every arriving control command is ignored (except SRES and STBY); and the response message is e.g. "SMAN 0 BS. If in the mode "SINT" 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 measuring device cannot process ("ESYZ K0 ABC", for example), 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 "Manual" to "Remote" at the device, it remains in "Manual" mode until a "SREM K0" is received by the control computer. On the display, this mode is indicated by REME" (Remote enable) on the status line. In manual mode, query commands via the serial interface are possible at any time.

#### AK Protocol Format

The master computer and the Siemens NOXMAT analyzer communicates via the RS232 serial link. The Siemens NOXMAT analyzer acts as a "slave" and only responds to commands.

#### Serial Interface Parameters:

- 1) Baud from 300 to 9600 bps, can be selected via the display.
- 2) 7 or 8 data bits, 1 or 2 stop bits, and the parity (yes/no).
- 3) The data transmission is full duplex (no echo) with XON/XOFF protocol.
- 4) The "don't-care" byte" (byte 2) is adjustable (factory setting 20H).

#### Command Format:

<STX>        02H Example: ASTZ K0  
 don't care    any byte (default 20H)  
 function code code 4 byte 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

#### Answer Format:

<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

### Scans

#### AKON: Measured concentration value

| Command  | Response                | Description  |
|----------|-------------------------|--|
| _AKON_K0 | _AKON_s_z.z_y.y_x.x_w.w | Measured concentration value is responded<br>z.z:current Measured Value<br>y.y:NO<br>x.x: NO2<br>w.w:Nox<br>y.y,x.x,w.w are only used in dual measure mode. Otherwise "O.O" will be returned |

#### AEMB: Set measuring range

| Command | Response | Description |
|---------|----------|-------------|
|---------|----------|-------------|

\_AEMB\_K0      \_AEMB\_s\_Mn      Current measuring range is responded

**AMBE:** Measuring range limit

| Command     | Response                            | Description                                       |
|-------------|-------------------------------------|---|
| _AMBE_K0    | _AMBE_s_M1_w.w_M2_x.x_M3_y.y_M4_z.z | All existing measuring range limits are responded |
| _AMBE_K0_Mn | _AMBE_s_Mn_z.z                      | Range limit of Range Mn is responded              |

**AKAK:** Calibration gas concentrations

| Command    | Response                            | Description                                       |
|------------|-------------------------------------|---|
| AKAK_K0    | _AKAK_s_M1_w.w_M2_x.x_M3_y.y_M4_z.z | All existing calibration gas values are responded |
| AKAK_K0_Mn | AKAK_s_Mn_z.z                       | Calibration gas value of Range Mn is responded    |

**AMBU:** Upper and lower range switchover values for autorange

| Command  | Response  | Description   |
|----------|---|---|
| _AMBU_K0 | _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 autorange are responded |

**ASTZ:** Normal device status

| Command  | Response                          | Description                |
|----------|-----------------------------------|----------------------------|
| _ASTZ_K0 | _ASTZ_s_SREM_STBY__SENO_SARE_SDRY | Device status is responded |

Possible states:

|                 |                                       |                   |                        |                      |
|-----------------|---------------------------------------|-------------------|------------------------|----------------------|
| SREM:<br>remote | STBY:<br>standby                      | SENO:<br>NO mode  | SARE:<br>Autorange on  | SDRY:<br>Chiller on  |
| SMAN:<br>manual | SPAU:<br>pause                        | SMAN:<br>NOx mode | SARA:<br>Autorange off | SWET:<br>Chiller off |
|                 | SMGA:<br>measuring gas                |                   |                        |                      |
|                 | SNGA:<br>zero gas                     |                   |                        |                      |
|                 | SEGA:<br>end gas                      |                   |                        |                      |
|                 | SATK SNGA:<br>zero gas during autocal |                   |                        |                      |
|                 | SATK SEGA:<br>end gas during autocal  |                   |                        |                      |
|                 | SLIN:<br>For compatibility only       |                   |                        |                      |
|                 | SSPL:<br>purging                      |                   |                        |                      |
|                 | SKOP:<br>measure                      |                   |                        |                      |

**ASTF:** Error status

| Command | Response | Description |
|---------|----------|-------------|
|---------|----------|-------------|

\_ASTF\_K0

\_ASTF\_s\_f1\_f2\_f3...f15

Current error number is responded

Errors:

|    |                               |
|----|-------------------------------|
| 1  | Sample Pressure Failure       |
| 2  | Air Pressure Failure          |
| 3  | Oven Temp Failure             |
| 4  | Converter Temp Failure        |
| 5  | Pump Temp Failure             |
| 6  | Diode Temp Failure            |
| 7  | Cell Temp Failure             |
| 8  | Peltier Gas Temp Failure      |
| 9  | Reaction Chamber Temp Failure |
| 10 | EPC Coil Sample Failure       |
| 11 | EPC Coil Air Failure          |
| 12 | Range Overflow                |
| 13 | ADC Range Overflow            |
| 14 | ADC Range Underflow           |
| 15 | Range 1 is not calibrated     |
| 16 | Range 2 is not calibrated     |
| 17 | Range 3 is not calibrated     |
| 18 | Range 4 is not calibrated     |

**AKEN:** Device identification

| Command  | Response               | Description                        |
|----------|------------------------|------------------------------------|
| _AKEN_K0 | _AKEN_s_devicename     | Device identification is responded |
| _AKEN_K1 | _AKEN_s_model          | Device model                       |
| _AKEN_K2 | _AKEN_s_serialno       | Device serial number               |
| _AKEN_K3 | _AKEN_s_airpressure    | Suggested input air pressure       |
| _AKEN_K4 | _AKEN_s_samplepressure | Suggested input sample pressure    |

**ARMU:** Rawvalue

| Command  | Response    | Description  |
|----------|-------------|--|
| _ARMU_K0 | _ARMU_s_z.z | Raw value before linearization and offset-span-correction is responded |

**ATEM:** Temperatures

| Command    | Response           | Description                                       |
|------------|--------------------|---|
| _ATEM_K0   | _ATEM_s_z.z.y.y... | All Temperatures in degrees celsius are responded |
| _ATEM_K0_x | _ATEM_s_z.z        | Temperature of x in degrees celsius is responded  |

Description of x:

| X | CLD            |
|---|----------------|
| 1 | Oven Temp      |
| 2 | Converter Temp |
| 3 | Pump Temp      |
| 4 | Diode Temp     |

|   |                       |
|---|-----------------------|
| 5 | Cell Temp             |
| 6 | Peltier Temp          |
| 7 | Reaction Chamber Temp |

**ADRU: Pressures**

| Command    | Response            | Description                 |
|------------|---------------------|-----------------------------|
| _ADRU_K0   | _ADRU_s_z.z_y.y_... | All pressures are responded |
| _ADRU_K0_x | _ADRU_s_z.z         | Pressure of x is responded  |

Description of x:

|   |                            |
|---|----------------------------|
| 1 | Sample Pressure            |
| 2 | Air Pressure               |
| 3 | Sample EPC Coil Voltage    |
| 4 | Air/Ozone EPC Coil Voltage |

**ADUF: Flows**

| Command    | Response            | Description             |
|------------|---------------------|-------------------------|
| _ADUF_K0   | _ADRU_s_z.z_y.y_... | All flows are responded |
| _ADUF_K0_x | _ADRU_s_z.z         | Flow of x is responded  |

Description of x:

|   |             |
|---|-------------|
| 1 | Sample Flow |
| 2 | Air Flow    |

**AGRD: Polynom coefficients**

| Command     | Response                  | Description                                    |
|-------------|---------------------------|--|
| _AGRD_K0_Mn | _AGRD_s_Mn_a0_a1_a2_a3_a4 | Polynom coefficients of range Mn are responded |

**AANG: Deviation from zero point after autocalibration**

| Command  | Response  | Description                                     |
|----------|---|---|
| _AANG_K0 | _AANG_s_M1_z.z_da_dr_<br>M2_z.z_da_dr_ M3_z.z_da_dr_<br>M4_z.z_da_dr_ | Deviation from zero point after autocalibration |

**AAEG: Deviation from end point after autocalibration**

| Command  | Response  | Description                                    |
|----------|---|--|
| _AAEG_K0 | _AANG_s_M1_z.z_da_dr_<br>M2_z.z_da_dr_ M3_z.z_da_dr_<br>M4_z.z_da_dr_ | Deviation from end point after autocalibration |



**AFDA:** Purge and Autocalibration times

| Command       | Response            | Description   |
|---------------|---------------------|---|
| _AFDA_K0_SATK | _AFDA_s_z_y_x_w_Z.Z | Autocalibration times:<br>z: Purge time<br>y: Calibration time<br>x: Total Calibration time<br>w: Verify time<br>(z,y,x,w in seconds) |
| _AFDAKO_SSPL  | AFDA_s_z.z          | Purge time will be responded  |

**APAR:** Request Autocalibration tolerance values

| Command       | Response                | Description   |
|---------------|-------------------------|---|
| _APAR_K0_SATK | _APAR_s_z.z_y.y_x.x_w.w | Autocalibration tolerance value(%):<br>z.z: Range 1<br>y.y: Range 2<br>x.x: Range 3<br>w.w: Range 4 |

**AKAL:** Deviations from calibration

| Command   | Response   | Description  |
|-----------|--|--|
| _AKAL_K0_ | _AKAL_s_M1_z.z_y.y_x.x_w.w<br>_AKAL_s_M2_z.z_y.y_x.x_w.w<br>_AKAL_s_M3_z.z_y.y_x.x_w.w<br>_AKAL_s_M4_z.z_y.y_x.x_w.w | Deviation (ppm):<br>z.z: Zero gas relative to last calibration<br>y.y: Zero gas factory calibration<br>x.x: Span gas relative to last calibration<br>w.w: Span gas factory calibration |

**ASYZ:** Respond System Time

| Command   | Response              | Description   |
|-----------|-----------------------|---|
| _ASYZ_K0_ | _ASYZ_s_yymmdd_hhmmss | Respond system time<br>yymmdd:year, month,day (each 2 characters wide, no spaces)<br>hhmmss:hour,minutes,seconds) |

**AT90:** Respond Lowpass filter time

| Command   | Response  | Description   |
|-----------|-----------|---|
| _AT90_K0_ | _AT90_s_t | Respond lowpass filter time<br>t=filter time in seconds |

**ADAL:**Diagnostic alarm limits

| Command    | Response                        | Description              |
|------------|---------------------------------|--------------------------|
| _ADAL_K0   | _ADAL_s_a1.min_a1.max_..f12.max | All alarms are responded |
| _ADAL_K0_x | _ADAL_s_x.min_x.max             | Alarm limits of x        |

Alarm Limits:

|    |                            |
|----|----------------------------|
| 1  | Sample Pressure            |
| 2  | Air Pressure               |
| 3  | Oven Temp                  |
| 4  | Converter Temp             |
| 5  | Pump Temp                  |
| 6  | Diode Temp                 |
| 7  | Cell Temp                  |
| 8  | Peltier Gas Temp           |
| 9  | EPC Coil Sample Voltage    |
| 10 | EPC Coil Air/Ozone Voltage |
| 11 | Reserved                   |
| 12 | Sample Content             |

**ATCP:** Query TCP/IP settings

| Command  | Response   | Description   |
|----------|--|---|
| _ATCP_K0 | _ATCP_s_zzz.zzz.zzz.zzz<br>_ATCP_s_yyy.yyy.yyy.yyy<br>_ATCP_s_xxxx | zzz: TCP/IP Address<br>yyy: TCP/IP subnet mask<br>xxxx: TCP/IP port |

**AENT:** Query calibration gas flow setting

| Command  | Response  | Description   |
|----------|-----------|---|
| _AENT_K0 | _AENT_s_x | x=10: Calibration through sample gas inlet (pump)<br>y=11: Calibration through zero/span valves |

**Control commands****SRES:** Reset

| Command  | Response | Description |
|----------|----------|-------------|
| _SRES_K0 | _SRES_s  | Reset       |

**SPAU:** Pause

| Command  | Response | Description |
|----------|----------|-------------|
| _SPAU_K0 | _SPAU_s  | Pause mode  |

**STBY:** Standby

| Command  | Response | Description  |
|----------|----------|--------------|
| _STBY_K0 | _STBY_s  | Standby mode |

**SNGA:** Open valve for zero gas calibration

| Command     | Response | Description   |
|-------------|----------|---|
| _SNGA_K0    | _SNGA_s  | Open valve for zero gas calibration of actual measuring range |
| _SNGA_K0_Mn | _SNGA_s  | Open valve for zero gas calibration of range Mn               |

**SEGA:** Open valve for end gas calibration

| Command     | Response | Description  |
|-------------|----------|--|
| _SEGA_K0    | _SEGA_s  | Open valve for end gas calibration of actual measuring range |
| _SEGA_K0_Mn | _SEGA_s  | Open valve for end gas calibration of range Mn               |

**SSPL:** Purge Analyzer with zero gas

| Command  | Response | Description                                    |
|----------|----------|--|
| _SSPL_K0 | _SSPL_s  | Open valve for zero gas and purge the analyzer |

**SLIN:** Linearization mode

| Command  | Response | Description                                    |
|----------|----------|--|
| _SLIN_K0 | _SLIN_s  | Change status to SLIN (only for compatibility) |

**SKOP:** Converter Check

| Command  | Response | Description   |
|----------|----------|---|
| _SKOP_K0 | _SKOP_s  | Change status to SKOP and activate sample pump (only for compatibility) |

**SWET:** Chiller off – Wet mode measuring

| Command  | Response | Description        |
|----------|----------|--------------------|
| _SWET_K0 | _SWET_s  | Switch chiller off |

**SDRY:** Chiller on – Dry mode measuring

| Command  | Response | Description       |
|----------|----------|-------------------|
| _SDRY_K0 | _SDRY_s  | Switch chiller on |

**SATK:** Start automatic calibration

| Command     | Response | Description                                |
|-------------|----------|--|
| _SATK_K0    | _SATK_   | Start automatic calibration of all ranges  |
| _SATK_K0_Mn | _SATK_s  | Start automatic calibration using range Mn |

**SEMB:** Set measuring range

| Command     | Response | Description                                  |
|-------------|----------|--|
| _SEMB_K0_Mn | _SEMB_s  | Set measuring range<br>Autorange is disabled |

**SARE:** Auto range on

| Command  | Response | Description  |
|--|----------|--|
| _SARE_K0   | SARE_s   | Set auto range on  |
| <b>SARA:</b> Auto range off                            |          |  |
| Command  | Response | Description  |
| _SARA_K0   | _SARA_s  | Set autorange off  |
| <b>SREM:</b> Remote mode for AK-commands               |          |  |
| Command  | Response | Description  |
| _SREM_K0   | _SREM_s  | Set device in remote mode  |
| <b>SMAN:</b> Manual control to control device manually |          |  |
| Command  | Response | Description  |
| _SMAN_K0   | _SMAN_s  | Set device in manual mode  |
| <b>SMGA:</b> Start measuring                           |          |  |
| Command  | Response | Description  |
| _SMGA_K0   | _SMGA_s  | Start measuring<br>Turn on pump for sample gas                                 |
| <b>SNKA:</b> Saves measured value as new offset.       |          |  |
| Command  | Response | Description  |
| _SNKA_K0   | _SNKA_s  | Saves measured value of actual range as new offset if zero valve is opened     |
| <b>SEKA:</b> Saves measured value as new span value    |          |  |
| Command  | Response | Description  |
| _SEKA_K0   | _SEKA_s  | Saves measured value of actual range as new span value if span valve is opened |
| <b>SENO:</b> Converter off                             |          |  |
| Command  | Response | Description  |
| _SENO_K0   | _SENO_s  | Set converter off<br>Only NO is measured                                       |
| <b>SNOX:</b> Converter on                              |          |  |
| Command  | Response | Description  |
| _SNOX_K0   | _SNOX_s  | Set converter on<br>All kinds of NOx are measured                              |
| <b>SNO2:</b> Converter on                              |          |  |
| Command  | Response | Description  |

|          |         |  |
|----------|---------|--|
| _SNO2_K0 | _SNO2_s | Activates dual measure mode.<br>Analyzer switches periodically<br>between NO and NOx mode and<br>displays NO, NO2, NOx |
|----------|---------|--|

**SFGR:** Reset calibration settings to factory defaultConverter on

| Command  | Response | Description   |
|----------|----------|---|
| _SFGR_K0 | _SFGR_s  | Reset all calibration settings to their<br>factory settings |

**SENT:** Set calibration gas flow

| Command    | Response | Description   |
|------------|----------|---|
| _SENT_K0_x | _SENT_s  | x=10: Calibration through sample gas<br>inlet (pump)<br>y=11: Calibration through zero/span<br>valves |

## Settings

**EKAK:** The four span gas concentration values are set

| Command                              | Response | Description        |
|--------------------------------------|----------|--------------------|
| _EKAK_K0_M1_w.w_M2_x.x_M3_y.y_M4_z.z | _EKAK_s  | Set end gas values |

**EMBE:** The four measuring range end values are set

| Command                              | Response | Description      |
|--------------------------------------|----------|------------------|
| _EMBE_K0_M1_w.w_M2_x.x_M3_y.y_M4_z.z | _EMBE_s  | Set range limits |

**EMBU:** The upper and the lower range switchover for autorange are set

| Command  | Response | Description                                    |
|--|----------|--|
| _EMBU_K0_M1_w.w_W.W_M2_x.x_X.X_M3_y.y_Y.Y_M4_z.z_Z.Z | _EMBU_s  | Set lower and upper range<br>switchover limits |

**EKEN:** Set new device identification

| Command                  | Response | Description   |
|--------------------------|----------|---|
| _EKEN_K0_new device-name | _EKEN_s  | Set new device identification<br>Maximum length of device name<br>are 40 characters |

NOTE: To change device identification, you must first rename the device to "RESET".  
Now a name up to 40 letters can be given.

NOTE: The device name must not have any blanks between, f.e. "Siemens CLD" is not allowed. You  
can use underscore, i.e. "Siemens\_CLD".

**EGRD:** Set polynom coefficients

| Command | Response | Description |
|---------|----------|-------------|
|---------|----------|-------------|

|                            |         |                                      |
|----------------------------|---------|--------------------------------------|
| _EGRD_K0_Mn_a0_a1_a2_a3_a4 | _EGRD_s | Set polynom coefficients of range Mn |
|----------------------------|---------|--------------------------------------|

**EFDA:** Set autocalibration and purge times

| Command               | Response | Description  |
|-----------------------|----------|--|
| _EFDA_K0_SATK_z_y_x_w | _EFDA_s  | Set autocalibration times:<br>z= Purge time<br>y=Calibration time<br>x=Total calibration time<br>w=Verify time<br>(z,y,x,w in seconds) |
| _EFDA_K0_SSPL_z       | _EFDA_s  | Set analyzer purge time to z seconds   |

**EPAR:** Set autocalibration tolerance values

| Command                           | Response | Description  |
|-----------------------------------|----------|--|
| _EPAR_K0_SATK_z.z_y.y_x.x_w.<br>w | _EPAR_s  | Autocalibration Tolerance value (%):<br>z.z= Range 1<br>y.y= Range 2<br>x.x= Range 3<br>w.w= Range 4 |

**ESYZ:** Set System Time

| Command                | Response | Description  |
|------------------------|----------|--|
| _ESYZ_K0_yymmdd_hhmmss | _ESYA_s  | Respond system time:<br>yymmdd:year, month,day (each 2 characters wide, no spaces)<br>hhmmss:hour,minutes,seconds) |

**ET90:** Set Lowpass Filter Time

| Command    | Response | Description   |
|------------|----------|---|
| _ET90_K0_t | _ET90_s  | Set lowpass filter time:<br>t= filter time in seconds |

**EDAL:**Diagnostic alarm limits

| Command                           | Response | Description           |
|-----------------------------------|----------|-----------------------|
| _EDAL_K0_a1.min_a1.mas_..._a12max | _EDAL_s  | Set all alarm limits  |
| _EDAL_K0_x_x.min_xmax             | _EDAL_s  | Set alarm limits of x |

## Alarm Limits:

|   |                  |
|---|------------------|
| 1 | Sample Pressure  |
| 2 | Air Pressure     |
| 3 | Oven Temp        |
| 4 | Converter Temp   |
| 5 | Pump Temp        |
| 6 | Diode Temp       |
| 7 | Cell Temp        |
| 8 | Peltier Gas Temp |

|    |                            |
|----|----------------------------|
| 9  | EPC Coil Sample Voltage    |
| 10 | EPC Coil Air/Ozone Voltage |
| 11 | Reserved                   |
| 12 | Sample Content             |

**ETCP: Set TCP/IP Parameters**

| Command                      | Response | Description                                       |
|------------------------------|----------|---|
| _ETCP_K0_ zzz.zzz.zzz.zzz    | _ETCP_s  | zzz= TCP/IP address                               |
| _ETCP_K0_ ___yyy.yyy.yyy.yyy |          | yyy= TCP/IP subnet mask                           |
| _ETCP_K0_ xxxx               |          | xxxx= TCP/IP port                                 |
|                              |          | All changes take effect after next power on cycle |

**Abbreviations used**

|             |   |
|-------------|---|
| Mn          | : Measuring range number  |
| M1 .. M4    | : Measuring Range 1 .. 4  |
| w.w .. Z.Z. | : Numerical value   |
| x           | : Number  |
| t           | : Numeric integer value   |
| a0 .. a4    | : Polynom 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 |

## 13.2 Rear Panel Connectors

28 Pin Main Connector Assignments:

| Signal Type | Analog                                |
|-------------|---------------------------------------|
|             | pin #                                 |
| A Output    | 1 GND (analog)<br>Realtime 0-10 VDC   |
| A Output    | 2 Maximum                             |
| A Output    | 3 NO 0-10 VDC Maximum<br>NOx 0-10 VDC |
| A Output    | 4 Maximum<br>NO2 0-10 VDC             |
| A Output    | 5 Maximum                             |
|             | <b>Digital</b>                        |
| D Output    | 6 GND (Digital)                       |
| D Output    | 7 Sense AutoRange                     |
| D Output    | 8 Sense Range 1                       |
| D Output    | 9 Sense Range 2                       |
| D Output    | 10 Sense Range 3                      |
| D Output    | 11 Sense Range 4                      |
| D Input     | 12 Set AutoRange                      |
| D Input     | 13 Control Range 1                    |
| D Input     | 14 Control Range 2                    |
| D Input     | 15 Control Range 3                    |
| D Input     | 16 Control Range 4                    |
| D Input     | 17 Auto Cal                           |
| D Input     | 18 Calibrate                          |
| D Input     | 19 Zero                               |
| D Input     | 20 Span                               |
| D Input     | 21 Pump                               |
| D Output    | 23 Span Gas Flow                      |
| D Output    | 24 Sample Gas Flow                    |
| D Output    | 25 Local/Remote                       |
| D Output    | 26 Read Cal Mode                      |
| D Output    | 27 Reserved                           |
| D Output    | 28 Reserved                           |

28 Pin Auxiliary Connector Assignments:

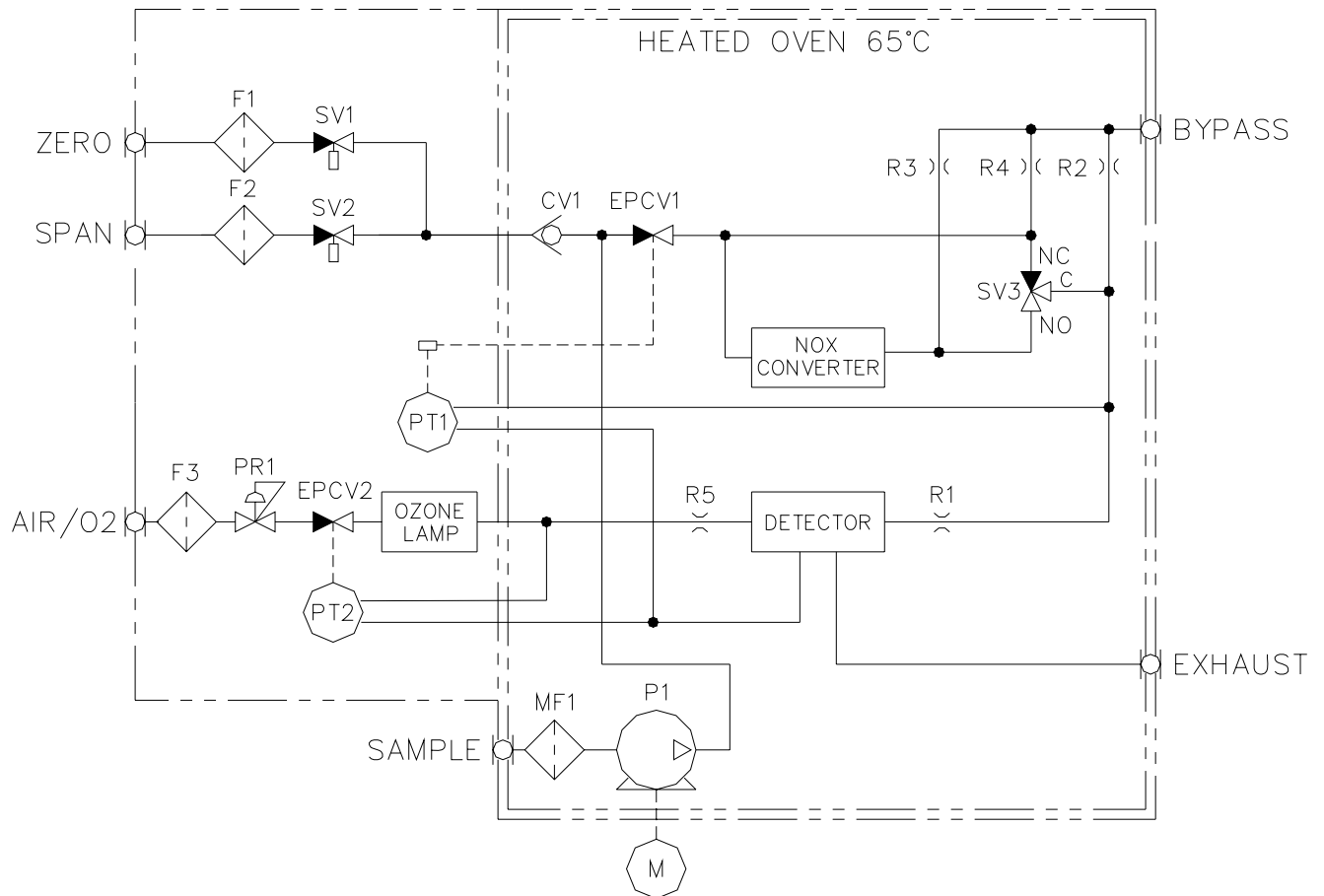
| Signal Type | Analog                 |
|-------------|------------------------|
|             | pin #                  |
| Spare       |                        |
| A Input     | 1 GND (analog)         |
| A Input     | 2 External Analog 1    |
| A Input     | 3 External Analog 2    |
| A Input     | 4 Spare analog         |
| A Input     | 5 Spare analog         |
|             | <b>Alarms</b>          |
| D Output    | 6 GND (Alarm)          |
| D Output    | 7 General Alarm        |
| D Output    | 8 Ch. 1 Conc. 1 Alarm  |
| D Output    | 9 Ch. 1 Conc. 2 Alarm  |
| D Output    | 10 Reserved            |
| D Output    | 11 Reserved            |
| D Output    | 12 Reserved            |
| D Output    | 13 Reserved            |
| D Output    | 14 Reserved            |
| D Output    | 15 GND (Alarm)         |
| D Output    | 16 Calibration Alarm 1 |
| D Output    | 17 Reserved            |
| D Output    | 18 Reserved            |
| D Output    | 19 Reserved            |
| D Output    | 20 Read Wet Mode       |
| D Output    | 21 Read OverFlow       |
| D Input     | 23 Set Wet Mode        |
| D Input     | 24 Set OverFlow        |
| D Input     | 25 Set NO Mode         |
| DI/DO       | 26 Spare               |
| DI/DO       | 27 Spare               |
| DI/DO       | 28 Spare               |



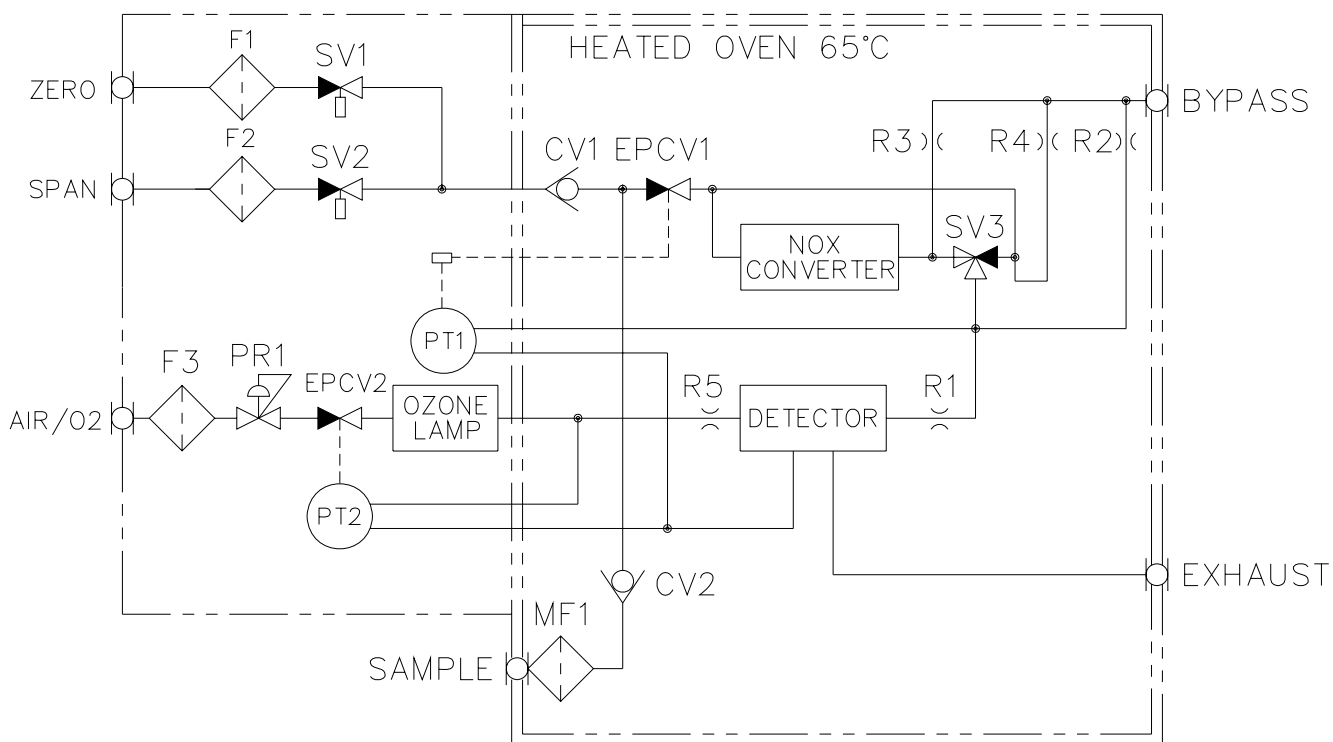
Note: All digital outputs and inputs are 0-5 VDC ONLY. All analog inputs are 0-10 VDC ONLY. Connecting analog outputs to existing current loop systems or voltage loop systems **WILL DAMAGE** the instrument.



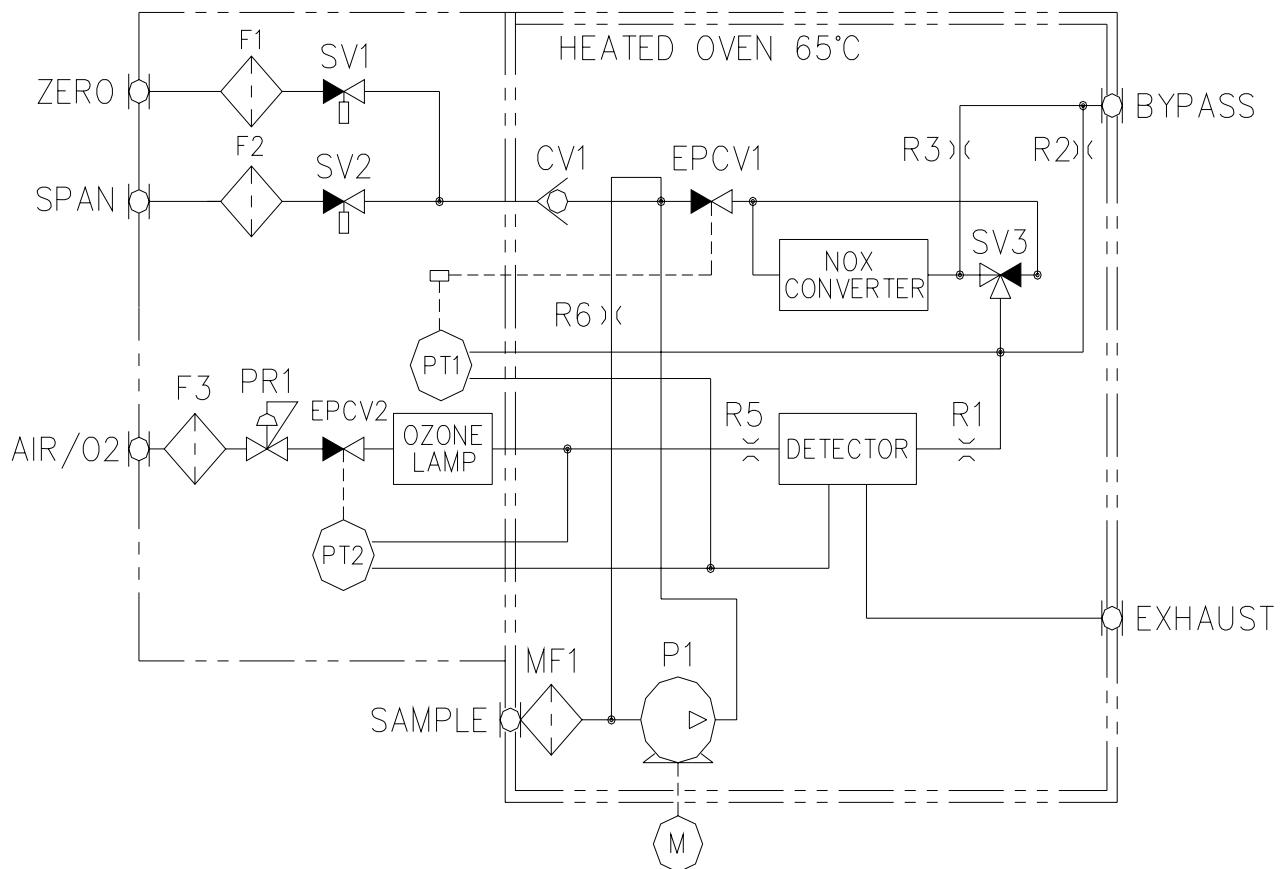
## Siemens NOXMAT Flow Diagrams



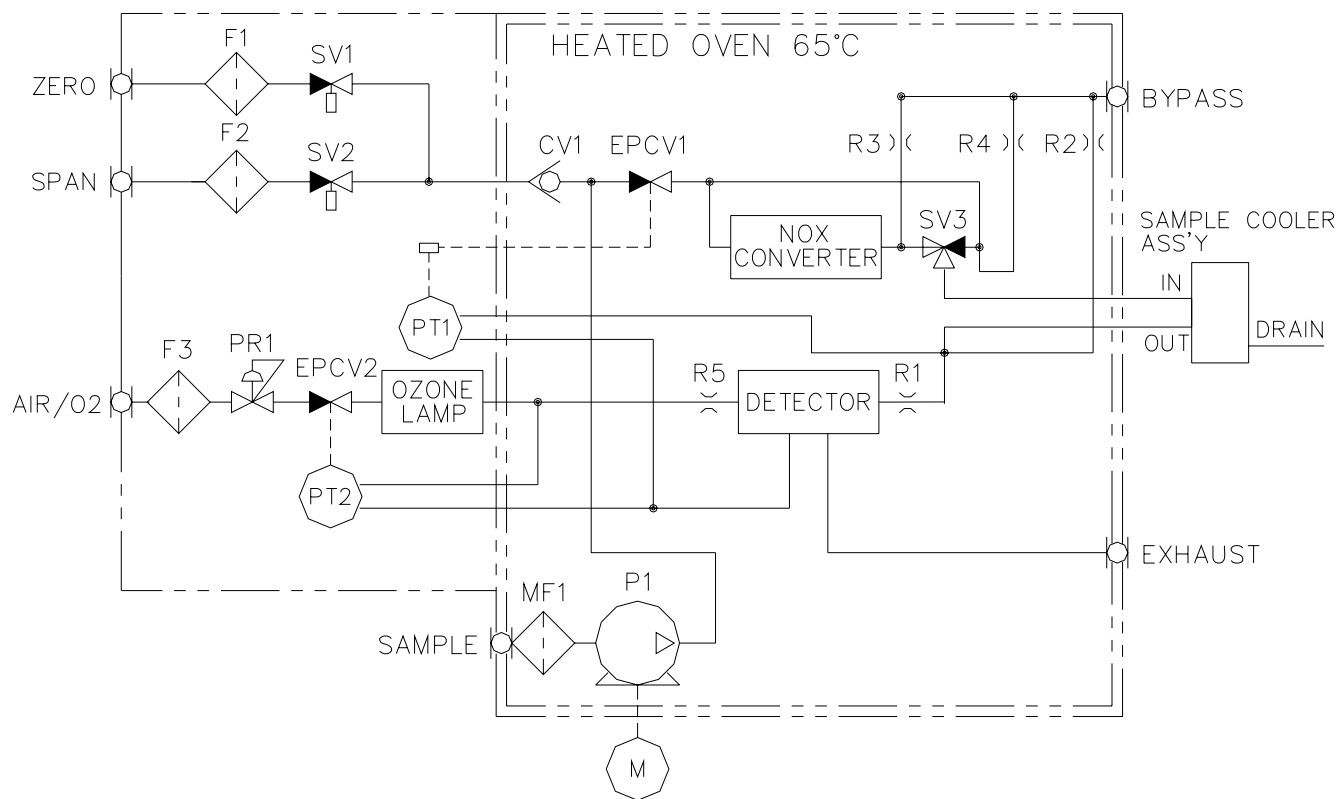
**NOTE:** Standard Analyzer With Internal Heated Sample Pump



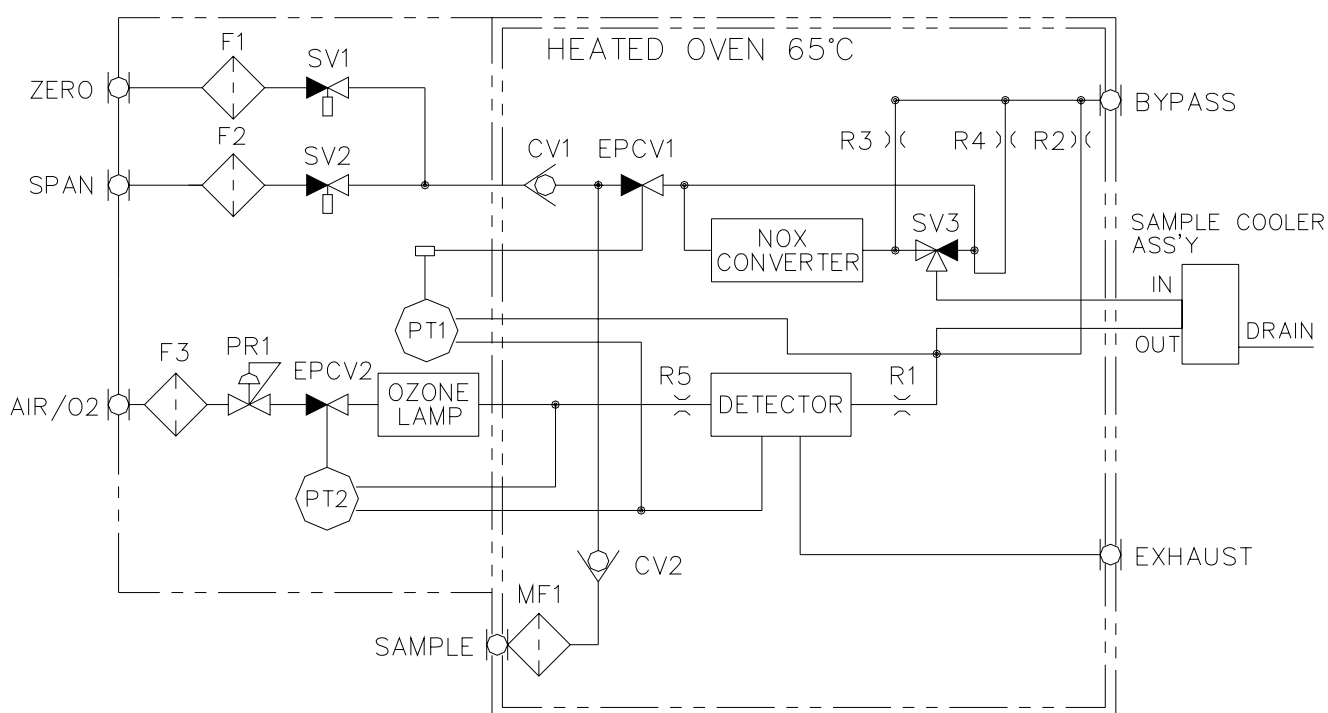
**NOTE:** Standard Analyzer Without Internal Heated Sample Pump



**NOTE:** Standard Analyzer With LOW FLOW OPTION



**NOTE:** Standard Analyzer With Internal Heated Sample Pump and Rear Mounted Chiller



**NOTE:** Standard Analyzer Without Internal Heated Sample Pump and Rear Mounted Chiller

### 13.3 Electrical Block Diagram

