600 SERIES

SO_2

UV Fluorescent SO_2 Analyzer

USER'S MANUAL

Note: Please See Addendum Starting After Page 47 of This Manual

Safety Alert
Caution or Warning

Temperature Hazard
Caution or Warning

Electrical Shock Hazard
Caution or Warning

UV Eye 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.

The  symbol (a UV lamp in a triangle) precedes an high intensity UV light eye 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 600 series UV SO_2 instruments meet or exceed 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)

600 UV SO_2 Quick Start Guide

1) Plug in the analyzer and turn the power on.
2) Connect the appropriate gas lines and vents to the analyzer.
3) Allow the analyzer to stabilize for at least one (1) hour.
4) During the analyzer's stabilization period, setup the analyzer to the desired configuration.
   a) Set the analyzer's output as desired.
      i) From the Main Menu press F5 (Setup) then F7 (System Settings.)
      ii) Press F3 (output assignments) to setup the output channels.
         (1) Set to real time.
         (2) AUX 1
         (3) AUX 2
         (4) AUX 3
         (5) Press back to return to the system settings menu.
      iii) Press F4 (output range) to setup the output ranges
         (1) Set the Min and Max to zero (0). This will cause the outputs to default to the current ranges.
         (2) Set the outputs for milliamps (mA) or voltage (V) as desired.
            (a) The mA setting will give 4-20 mA or 2-10V (if 500 ohm resisters are installed.
            (b) The V setting will give 0-20mA or 0-10V (if 500 ohm resistors are installed.

Disconnect power before proceeding

5) Connect all appropriate analog outputs.
   a) Pin 1 is the output common (ground).
   b) Pins 2, 3, 4, and 5 are output channels 1, 2, 3, and 4 as setup in step 4.a.ii.
   c) If the output is set for voltages but there is no voltage output, you will need to install a 500 ohm resistor between pin 1 and the channel you are trying to measure. You will have to measure the voltage drop across this resistor.
6) Reconnect the power and turn on the analyzer. Press F1 from the analyzer's main Menu to get to the measurement screen.
7) Supply sample gas to the analyzer.

8) The measurement screen should indicate the concentration of the sample gas. If the concentration is incorrect, the analyzer will need to be calibrated using zero and span calibration gases. Please reference the appropriate section of the manual for a description on how to zero and span the analyzer.

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Removed for revision

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 California Analytical Instruments 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 either to 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

California Analytical Instruments, Inc.

1312 West Grove Avenue
Orange, CA 92865
714 974-5560
Fax 714 921-2531
Website: www.gasanalyzers.com

1.5. Warranty Certificate

Subject to the exceptions and upon the conditions stated below, California Analytical Instruments (CAI) 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 CAI and if any such product should prove to be defective within such one year period, CAI agrees, at its option, either (i) to correct by repair or, at CAI's 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 CAI that by their nature are not intended to or will not function for one year are warranted only to give reasonable service for a reasonable time. What constitutes reasonable time and reasonable services shall be determined solely by CAI. A complete list of such components and accessories is maintained at the factory;

b. CAI makes no warranty with respect to components or accessories not manufactured by it; in the event of defect in any such component or accessory CAI 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 CAI 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. CAI 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. CAI 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 CAI 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 HAVE OTHER RIGHTS, WHICH VARY FROM STATE TO STATE.

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

1.6. Proper Operation

Personnel should be trained in the proper operation of this equipment before attempting to operate the equipment.

1.7. Possible Explosion Hazard

Do not apply power to the analyzer or attempt to energize the analyzer until determining the analyzer environment to be non-hazardous.

Use this analyzer in **a NON-HAZARDOUS** environment.

This analyzer has not been designed for use with a hazardous sample.

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

1.8. Electrical Shock Hazard

Disconnect power before removing cover. Servicing requires access to live electrical components that can cause death or serious injury. Refer servicing to qualified service personnel. For safety and proper performance, connect this instrument to a properly grounded three-wire receptacle.

Caution

1.9. Plug Removal

Before operating this analyzer REMOVE the red plastic ¼ inch plugs from the sample inlet and exhaust fittings on the rear panel.

Use of this equipment in a manner not approved by California Analytical Instruments is not recommended and may cause harm to the equipment or operating personnel.

2. Features

2.1. Description

The 600 series SO2 analyzer is based on the fluorescence of SO2 due to the absorption of ultraviolet (UV) energy. A special lamp emits ultraviolet radiation, which passes through a filter, exciting the SO2 molecules and producing fluorescence that is measure by a photomultiplier tube (PMT).

The analyzers have 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 blank screen is illuminated.

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.

2.2. Features-General

High stability is provided by an improved photometric system, which assures less influence due to contamination of the measuring cell and higher long-term stability than conventional dual-beam analyzers.

- A new, compact photomultiplier tube (PMT).
- Integrated Peltier PMT cooling.
- 10,000 Hour rated ultraviolet lamp.
- Temperature and pressure compensation.
- Optional NDIR CO2 or paramagnetic O_2 channel.
- Compact size.

2.3. UV Fluorescence Gas Analyzers

The UV fluorescence gas analyzer measures gas concentration based on the principle that SO2 will fluoresce when exposed to ultra-violet light.

The instrument consists of a UV light source, optical filter, measuring cell, second optical filter, and a detector. In addition, there are lenses and baffles to focus the light. The measuring principle of the instrument is in Figure 2-1. The light source emits UV light in the direction of the measurement cell. The light is focused and wavelength filtered as it enters the measurement cell. The optical filter blocks UV at wavelengths longer that 230nm.

The UV is absorbed by the SO2 in the measurement cell. The SO2 absorbs UV at wavelengths between190nm and 230nm, and then emits the energy as UV at wavelengths between 230 and 420 nm.

At a right angle to the incoming beam of UV light is the port for the detector. The detector is a very sensitive photomultiplier tube. The detector port has a filter that block UV shorter than 230nm, as well as a focusing lens. The two filters keep the detector from sensing the UV light from the lamp, so only UV light emitted by SO2 is measured. The amount of energy picked up by the sensor is directly proportional to the concentration of the SO2 in the measurement cell.

Also shown in the figure is a light sensitive photo-diode that is looking directly at the light source. This is used to measure the strength of the UV lamp so that the analyzer can compensate for aging of the lamp.

The outlet of the measurement cell is connected to a pressure sensor, to allow for compensation of changes in pressure.

The measurement cell is heated to 54°C, and controlled by a temperature sensor to keep the temperature stable.

(Figure 2-3)

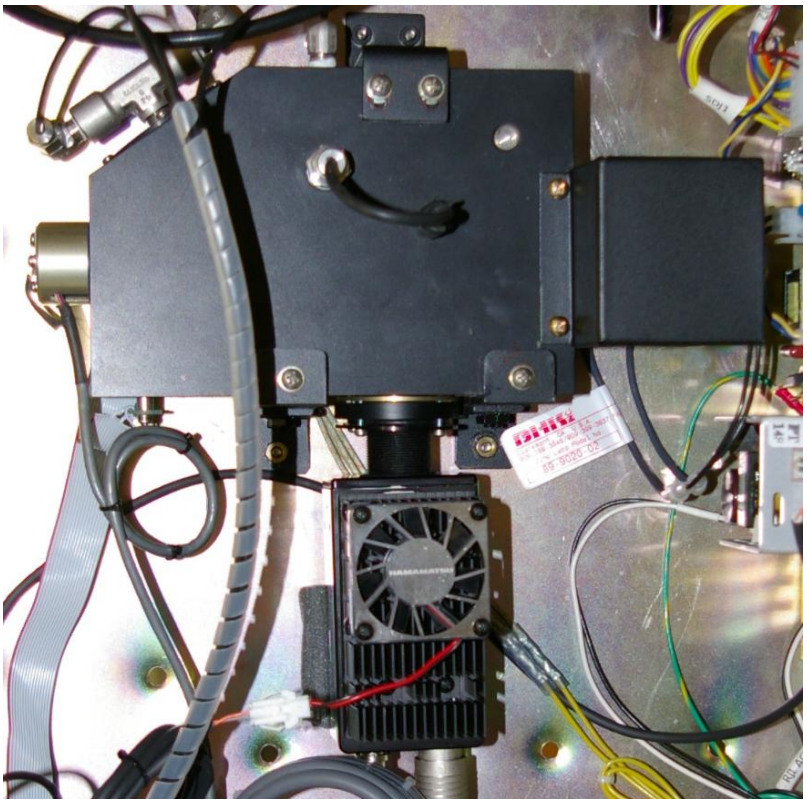


Figure 2-1 UV SO2 Optical Bench

Figure 2-2 Pending

Figure 2-3 Pending

2.4. Interference Gases

If a sample contains a gas component with a fluorescence response similar to the gas to be measured, that gas is commonly referred to as an interference gas. The measurement cell was specifically designed to minimize the effect of interference gases. .

2.5. Electronics

The output signal of the photomultiplier is connected to the high gain current amplifier on the SO2 interface board. The signal amplitude is related to the measured gas concentrations in the sample cell.

This signal is amplified by successive DC amplifiers and filtered. The DC signal output of the printed circuit board is the input to the microprocessor board. Here it is digitized and linearized for digital display

The digitized information is then fed to a D/A Converter so it can be isolated and converted to a 0-10 VDC or 4-20 mA output. This output (along with optional alarm contacts) is sent to the 28-pin output connector located on the rear panel of the analyzer for customer connection.

ILLLUSTRATION PENDING

Figure 2-4 Block Diagram

2.6. Model 600 SO_2 Specifications

ANALYSIS METHOD	Continuous Ultra-Violet (UV) Fluorescence
COMPONENTS	SO_2
DETECTOR TYPE	Photomultiplier Tube (PMT) with integrated Peltier Cooling
RANGE RATIO	200:1 (Highest Range/50 = Lowest Range)
RESPONSE TIME	Approximately 17 seconds to T90 (Depending on range)
UV SAMPLE CHAMBER	Temperature controlled Teflon lined block
RESOLUTION	Typically better than 0.2 ppm (Depending on range
REPEATABILITY	Better than 0.5% of Full Scale
LINEARITY	Better than 1% of Full Scale
NOISE	Typically Less than 0.1 ppm (Depending on range and time constant)
ZERO & SPAN DRIFT	Less than 0.5% of Full Scale per 24 Hours
ZERO & SPAN ADJUSTMENT	Via front panel, TCP/IP or RS-232
SAMPLE FLOW RATE	0.5 to 2.0 Liters/minute (LPM)
OXYGEN ANALYSIS METHOD	Paramagnetic
O_2 RANGES	0 — 1% up to 0 – 100% O_2 Full Scale, Four Definable Ranges
O2 RESPONSE TIME	T90 < 15 Seconds
CO_2 ANALYSIS METHOD	NDIR
CO_2 RANGES	
CO_2 RESPONSE TIME	T90 < 15 Seconds

2.7. Model 600 SO_2 Features

OUTPUTS AVAILABLE	TCP/IP, RS232, Four Scalable Analog 0-10 V / 4-20 mA (Allows Offset and Expandable Range DC Analog Outputs)	
DISCRETE CONTROL	Remote/Local Control, Range Change, Range Sense Mode (Al TTL Logic)	
DISCRETE ALARMS (Local & Remote Adjustable)	General Fault/ TTL Logic 0-5 VDC(Ground True) Calibration Failure/ TTL Logic 0-5 VDC (Ground True) High Concentration (2 each)/ TTL 0-5 VDC Logic (Ground True)	
KEYPAD DISPLAYS	Factory Settings TCP/IP Address Passwords (4)	Scalable Analog Output Voltages Full Scale Range Select Auto Cal Times
SPECIAL FEATURES	Auto Ranging Auto Calibration (adjustable through internal clock)	
DISPLAY	3” x 5” Back lit LCD	
SAMPLE TEMPERATURE	Up to 50°C Non-condensing	
AMBIENT TEMPERATURE	5 to 40°C	
AMBIENT HUMIDITY	Less than 90% RH Non-condensing	
WARM-UP TIME	1 Hour (Typical)	
FITTINGS	1/4 Inch Tube	
POWER REQUIREMENTS	115 V 60Hz (Option: 230V 50Hz), ±10%, 600W	
DIMENSIONS	5¼ H × 19 W × 23 D (Inches)	
WEIGHT	30-45 Pounds (Depending on configuration)	

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

3. Installation

3.1. General

The design of this instrument is for industrial applications. These installation instructions are for a typical site. Direct any questions regarding specific installation situations to Technical Support of California Analytical Instruments, Inc.

3.2. Site and Mounting

NOTE: Carefully observe the following precautions:

Select a site free from direct sunlight, radiation from a high temperature surface, or abrupt temperature variations.

This analyzer is not suitable for installation outdoors.

Select a site where the air is clean. Avoid exposing the instrument to corrosive or combustible gases.

The instrument must not be subject to severe vibration. If severe vibration is present, use isolation mounts.

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

Do not install near equipment emitting electromagnetic interference (EMI).

NOTE: A rear supporting brace or equivalent is required for rack mount 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 in it a way that the power on/off switch is inaccessible.

3.3. Electrical

All wiring is connected at the rear of the instrument. The AC power is connected to the power/fuse/switch as shown below

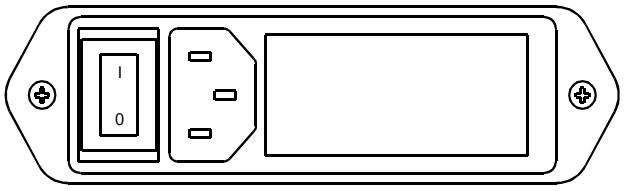


Figure 3-1 AC Power Switch, Connector, and Fuse.

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 and rating indicated on rear panel of instrument. Replacement with any other fuse may cause damage to the instrument and possible injury to operating personnel.

3.4. Analog Output Connections (Appendix)

See Appendix for connector pin-outs located on the analyzer rear panel. Remote range identification and range selection are obtained via 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 on the front panel switch, 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.

3.5. Gases

1) Nitrogen or (zero air) in pressurized cylinder.
2) Standard span gas(es) near full-scale concentration with a nitrogen balance, in a pressurized, certified cylind9er.

3.6. Gas Handling Equipment Requirements

1) Pressure regulators for zero gas (Air or N2), and span gas cylinders.
2) Corrosive resistant gas tubing.

3.7. Gas Connections

The tubing from the sampling system to the gas analyzer should be made from corrosive-resistant material such as Teflon or stainless steel. Even when the gases being sampled are not corrosive, 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 completely eliminated. 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 instrument temperature to prevent accidental condensation within the instrument. Bypass the sample through a dehumidifier to reduce the dew point to about 2 to 4° C or less. If the sample contains an acid mist, use an acid mist filter, cooler or similar device to remove all traces of the mist.

3.8.3. Presence of Corrosive Gases

High concentrations of corrosive gases such as Cl_2, F_2, HCl, in the sample gas shorten the useful service life of the instrument.

3.8.4. Gas Temperature

Do not exceed the maximum rating of the instrument 104º F (50º C) when measuring high temperature gases.

3.8.5. Sample Gas Outlet (Vent)

A sample gas 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.

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.

Display

The analyzer's LCD display includes 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 that is formatted into 4 information areas.

Figure 4-1 LCD Display

1) **The top information in area contains**:

   a) 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. This feature is off in most examples in this manual.

      i) SARE Auto range enabled

      ii) SMGA Measuring gas is flowing

      iii) SMAN Device is in manual operation status

      iv) SWET Device

   b) Shown on the top right is the Password Entry level with 1 to 4 horizontal lines.

2) **The large information area** is the data portion of the screen.

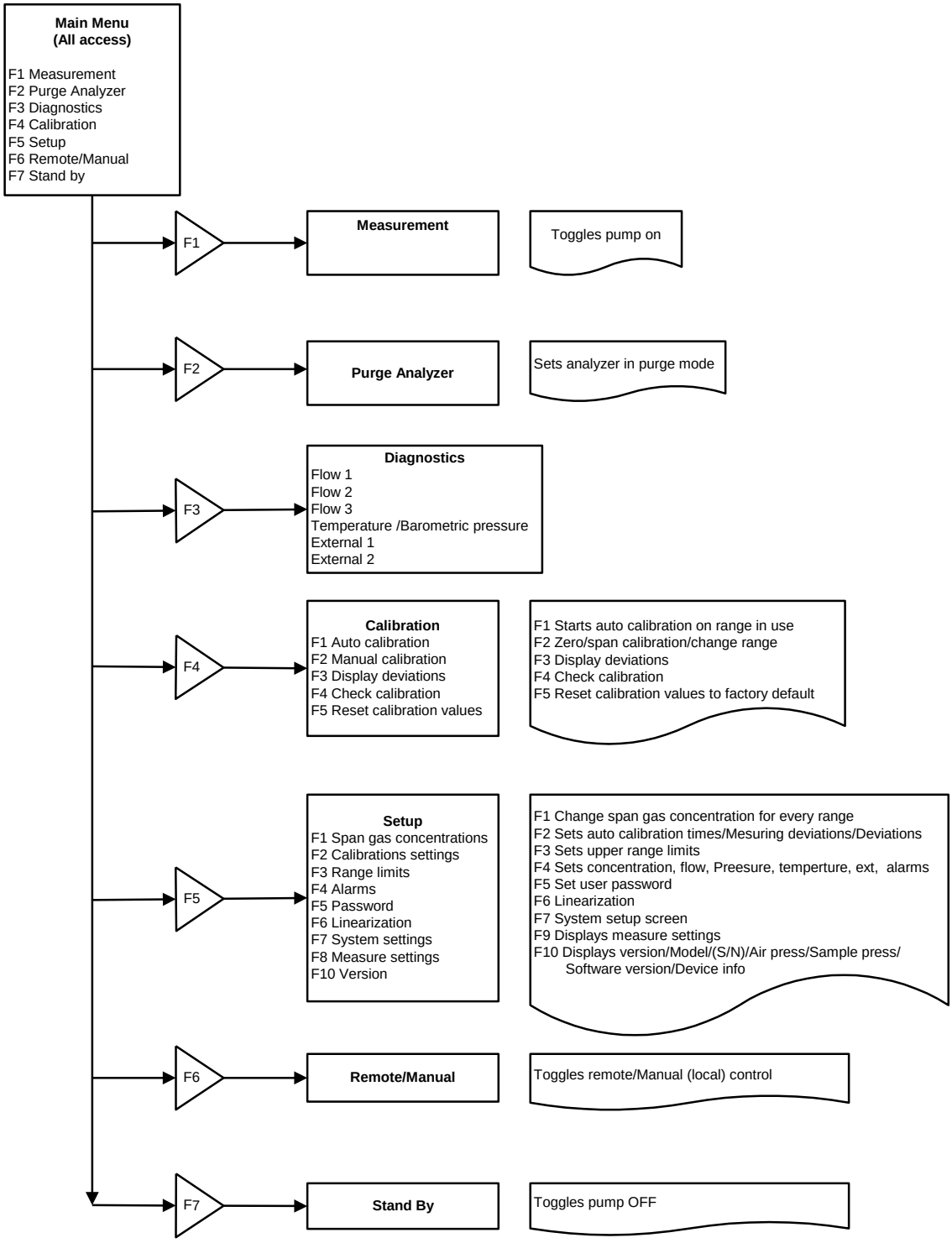
3) **The third information area contains** the help information for the parameter selected, ranges, etc.

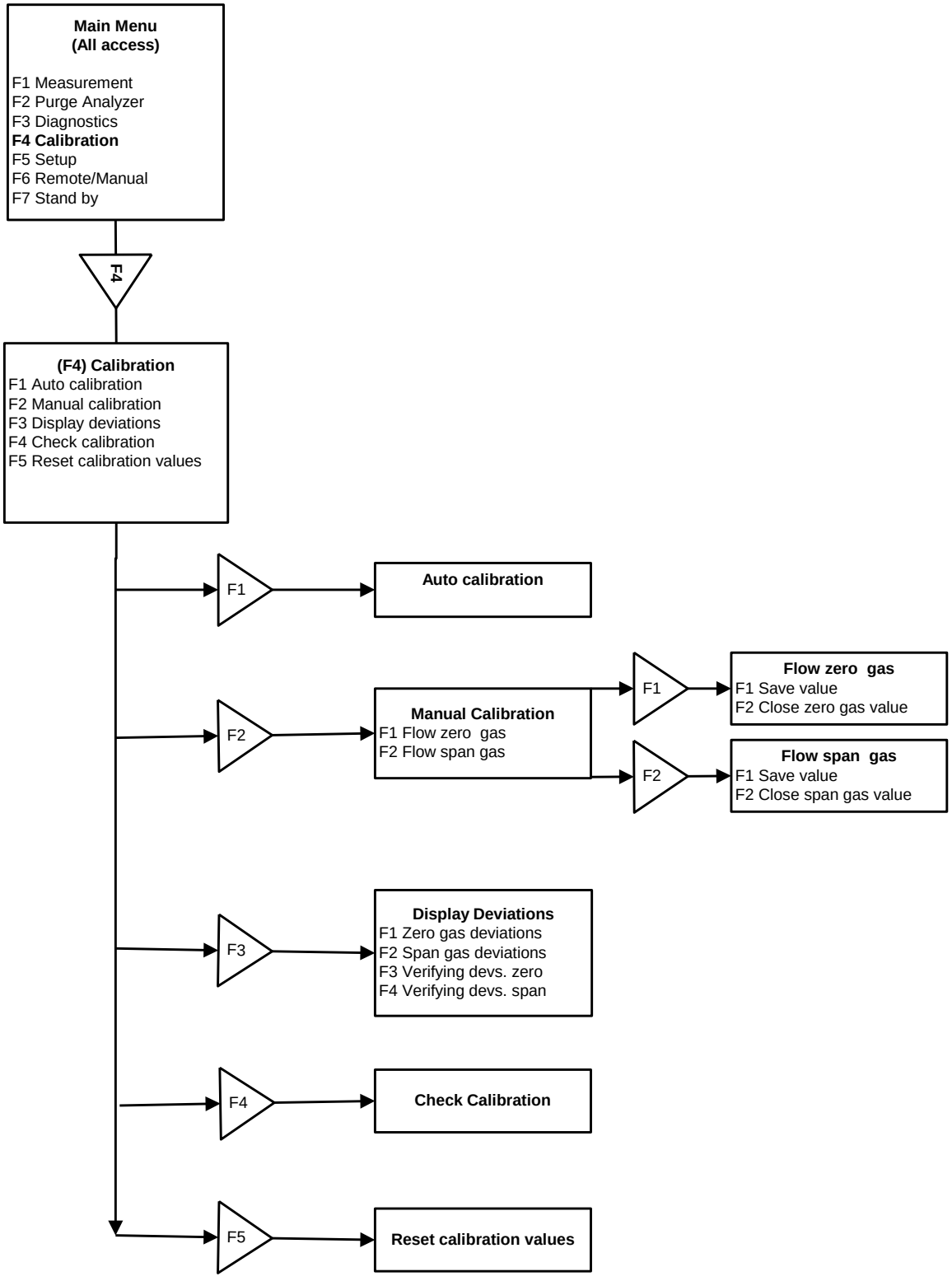
4) **The bottom information area** contains the time and date and any error condition.

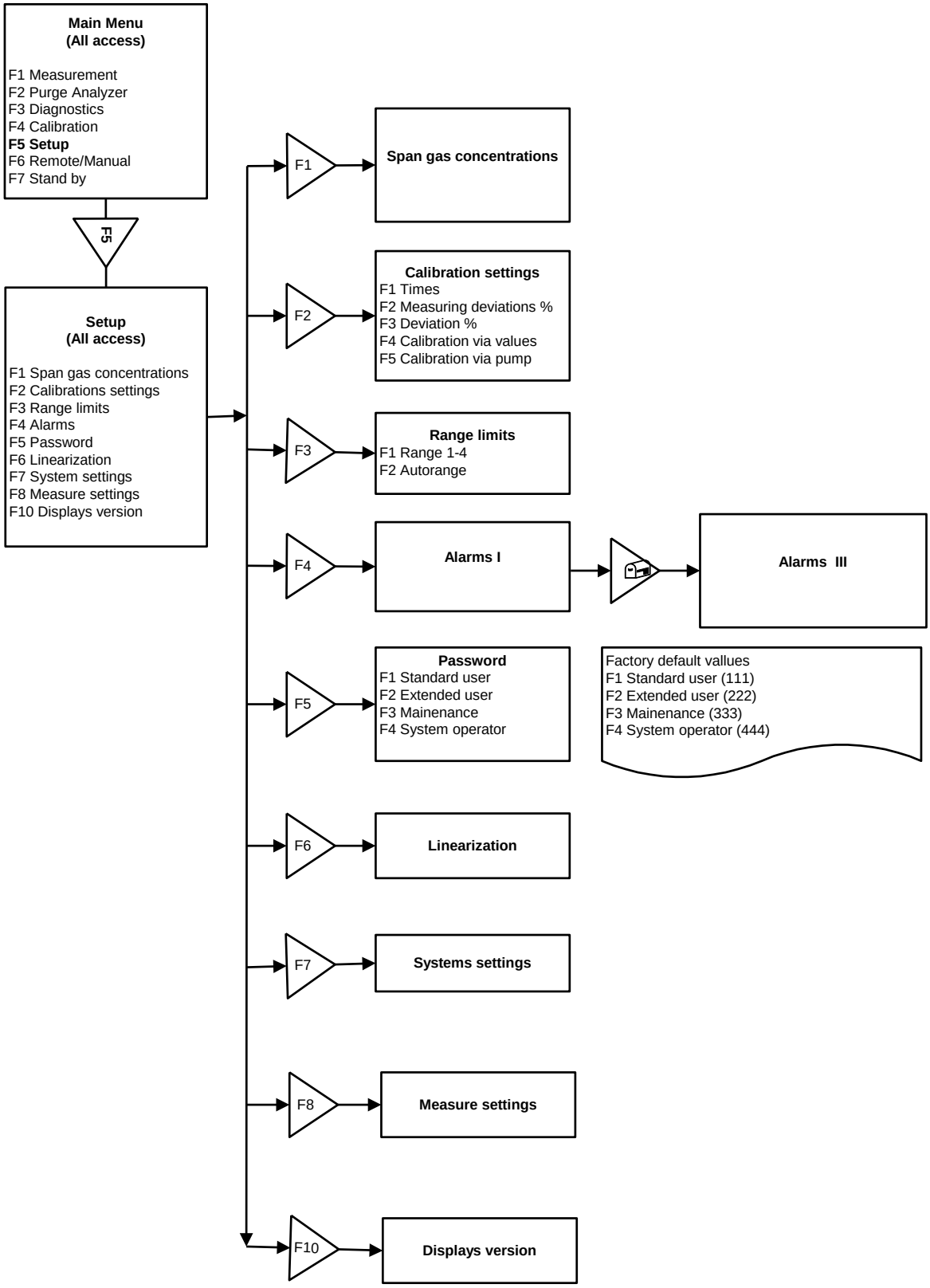
   a) The symbol in the bottom right corner indicates the keyboard mode. In the example shown, the keyboard is in the function key mode. For input fields, the mode is usually switched to numerical input. Then, an N appears in the lower right of the screen. This symbol is displayed on all screens.

4.1. Menu Trees

Model 601 Menu Tree




Main Menu
(All access)
F1 Measurement
F2 Purge Analyzer
F3 Diagnostics
F4 Calibration
F5 Setup
F6 Remote/Manual
F7 Stand by
F4
(F4) Calibration
F1 Auto calibration
F2 Manual calibration
F3 Display deviations
F4 Check calibration
F5 Reset calibration values
F1
Auto calibration
F2
Manual Calibration
F1 Flow zero gas
F2 Flow span gas
F1
Flow zero gas
F1 Save value
F2 Close zero gas value
F2
Flow span gas
F1 Save value
F2 Close span gas value
F3
Display Deviations
F1 Zero gas deviations
F2 Span gas deviations
F3 Verifying devs. zero
F4 Verifying devs. span
F4
Check Calibration
F5
Reset calibration values


Main Menu
(All access)
F1 Measurement
F2 Purge Analyzer
F3 Diagnostics
F4 Calibration
F5 Setup
F6 Remote/Manual
F7 Stand by
F5
Setup
(All access)
F1 Span gas concentrations
F2 Calibrations settings
F3 Range limits
F4 Alarms
F5 Password
F6 Linearization
F7 System settings
F8 Measure settings
F10 Displays version
F1
Span gas concentrations
F2
Calibration settings
F1 Times
F2 Measuring deviations %
F3 Deviation %
F4 Calibration via values
F5 Calibration via pump
F3
Range limits
F1 Range 1-4
F2 Autorange
F4
Alarms I
Alarms III
F5
Password
F1 Standard user
F2 Extended user
F3 Mainenance
F4 System operator
Factory default vallues
F1 Standard user (111)
F2 Extended user (222)
F3 Mainenance (333)
F4 System operator (444)
F6
Linearization
F7
Systems settings
F8
Measure settings
F10
Displays version

4.2. Keyboard

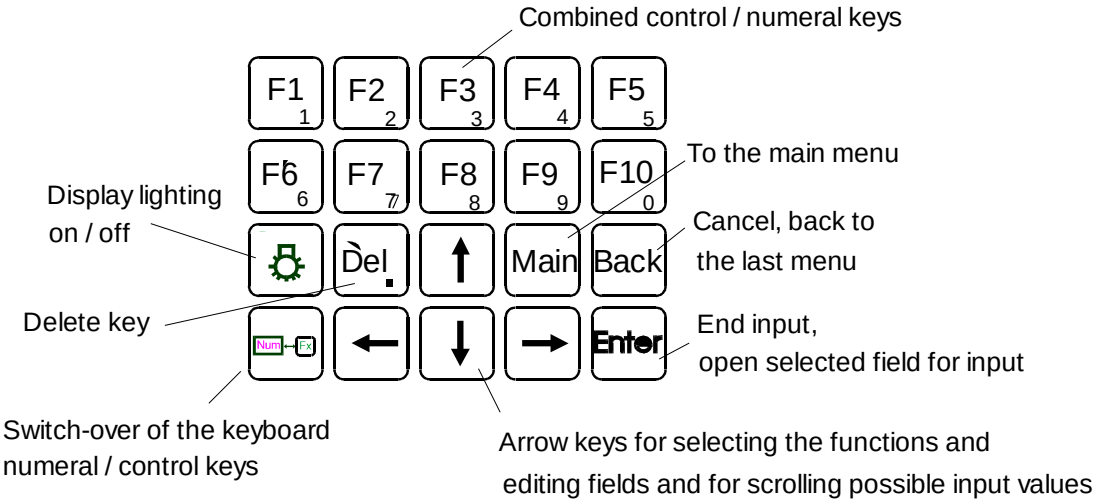


Figure 4-2 Keyboard

4.2.1. 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.

4.2.2. Operation with the Function Keys

When using the function keys (Fl though F10), functions are directly accessed 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.

4.2.3. 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 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 CAI 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 and change to a higher level if needed.

5.1. The Main Menu

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

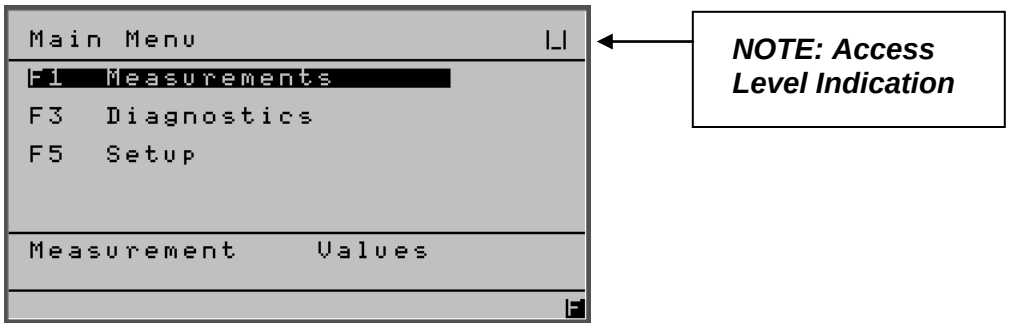


Figure 5-1 Main Menu on Power Up Screen

NOTE: F6 is not available because, on initial start up, the analyzer reverts to ONLY Level 1 access. See the start of this Section 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.

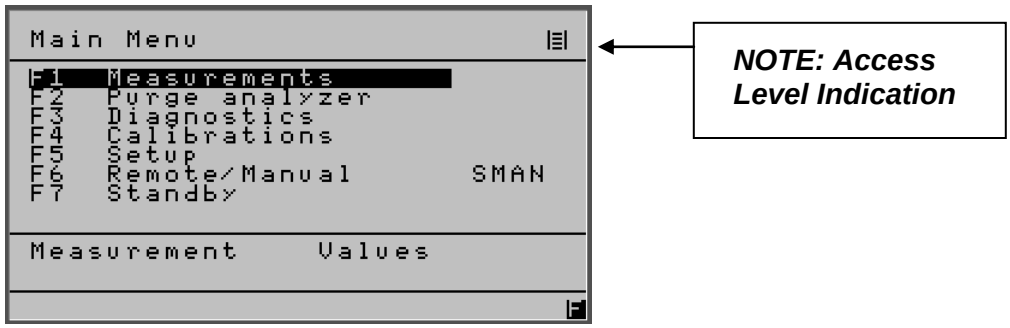


Figure 5-2 Main User Menu (Level 4)

6. Menu Structure

There are four 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		Setup Menu		Password Menu	
F1	Measurements	F5	Password	F1	Enter password
F2	Purge Analyzer	F10	Version		
F3	Diagnostics				
F4	Calibrations				
F5	Setup				
F7	Standby				

6.2. Advanced User Functions (Level 2)

Main Menu		Setup Menu		Password Menu	
F1	Measurements	F3	Range Limits	F1	Enter password
F2	Purge Analyzer	F5	Password		
F3	Diagnostics	F10	Version		
F4	Calibrations				
F5	Setup				
F7	Standby				

6.3. Maintenance Functions (Level 3)

Main Menu		Setup Menu		Password Menu		System Settings Menu	
F1	Measurements	F1	Span Gas Concentration	F1	Enter password	F1	Real Time Clock
F2	Purge Analyzer	F3	Range limits	F2	Reset password	F5	Status Line on/off
F3	Diagnostics	F5	Password	F7	Auto Startup		
F4	Calibrations	F7	System Settings				
F5	Setup	F8	Measure Settings				
F7	Standby	F10	Version				

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

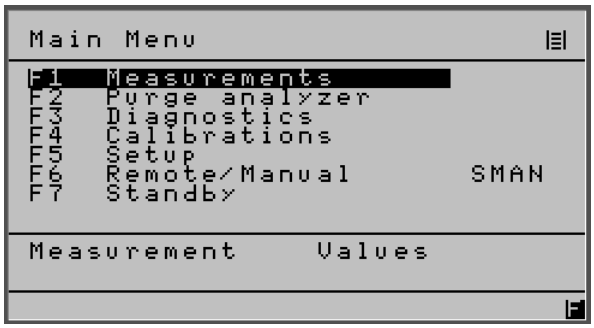


Figure 7-1 Main Menu Screen

7.1.1. F1 Measurement

The measurements screen is activated by pressing F1 on the Main Menu screen. The concentration is displayed in actual engineering units.

Figure 7-2 Measurements Screen

7.1.2. Range Select

With the arrow keys, ranges 1 to 4 can be selected and locked in. This action 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.

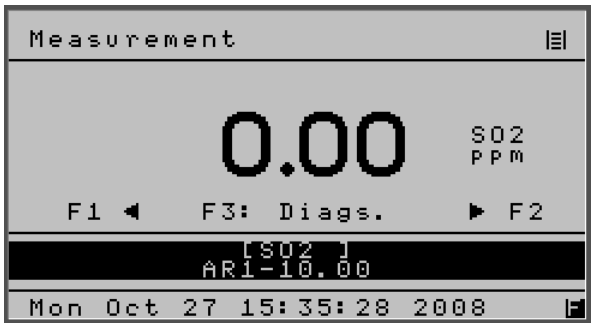


Figure 7-3 Set to Auto Range

AR1-10.00 = Auto Range, Range is 1, Range Span is 10.00

Figure 7-4 Analyzer set to Range 1

R1-10.00 – Manual Range, Range is 1, Range Span is 10.00

7.2. F2 Purge Analyzer

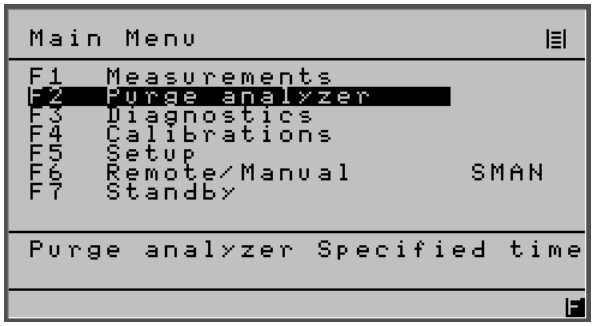


Figure 7-5 Main Menu (User Level 4)

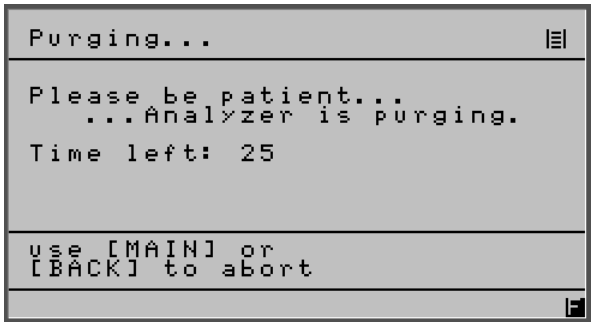


Figure 7-6 Purge Screen

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

7.3. F3 Diagnostics

F3 from the Main Menu activates the Diagnostics function. F3 brings up the two diagnostics screens. The Diagnostics screens may be brought up from **EITHER** the Main Menu or the Measurements screen.

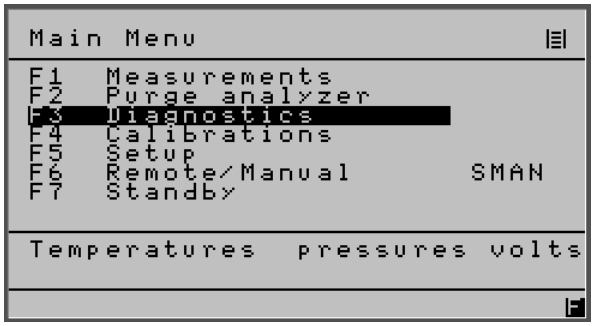


Figure 7-7a Main Menu (User Level 4) and, and

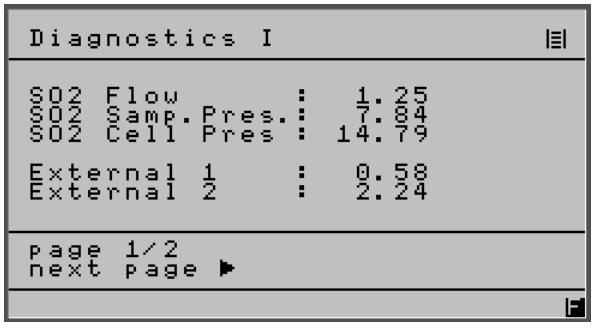


Figure 7-8b Diagnostics Screen I

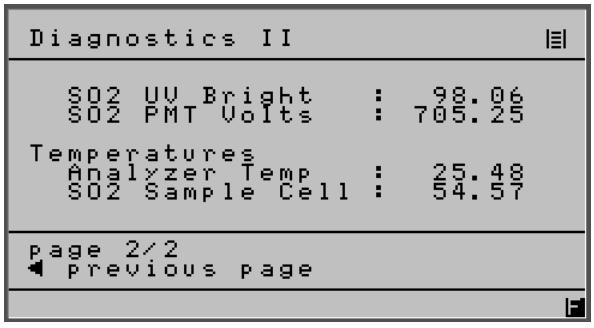


Figure 7-9b Diagnostics Screen II

7.4. F4 Calibrations

Selecting 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.

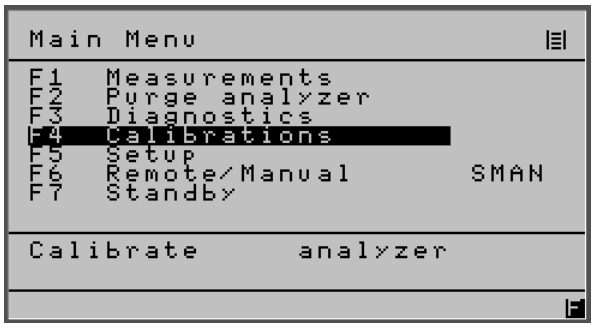


Figure 7-10a Main Menu (User Level 4)

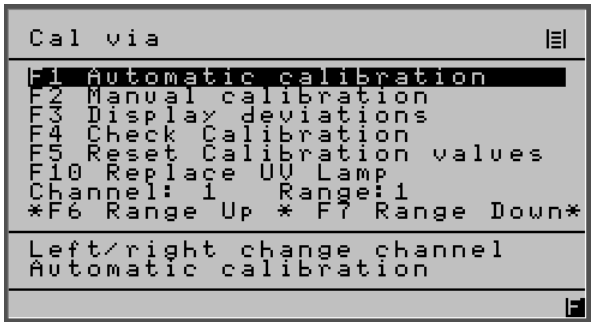


Figure 7-11b Calibration Screen

7.4.1. F1 Automatic Calibration

From the Calibrations screen, pressing F1 starts automatic calibration. If auto range is selected, the actual range in use will be calibrated.

Auto calibration works as follows:

1. Zero gas is purged for an interval, called purge-time.
2. The measurement begins. The measured value must be stable for an interval, called measuring-time, and within an upper and a lower limit to be saved as the new offset value. The maximum length of the measuring time is 9 seconds.
    a. If the measured value was constant during the measuring time, the new value is checked to determine the deviation from the previous calibration's value.
    b. If the deviations are larger than those set by the user, a warning "Deviation error!" appears and the user can choose if the new value is to be saved or not.
3. Zero gas flow continues for a verifying time, to check that the signal is still constant.

All of these times can be changed. After zero gas calibration, the process repeats with span gas. During auto calibration, "Calibration in progress" is displayed, and of the screen 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 that range 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 those ranges. 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 individually. Offsets and scalors are NOT copied to other ranges.

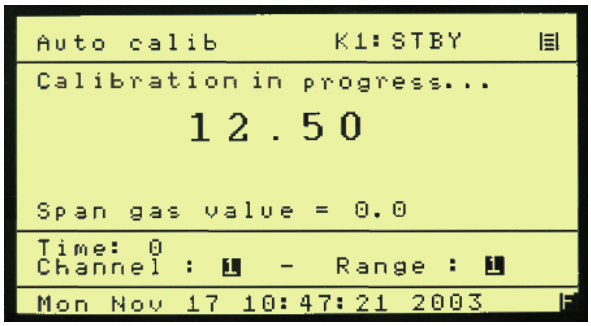


Figure 7-12 Auto Calibration Screen(NEW PIC PENDING)

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.

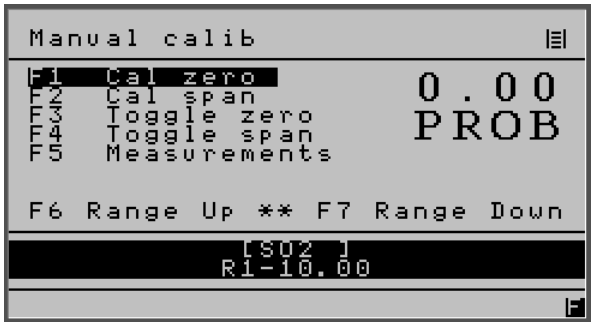


Figure 7-13 Manual calibration

In the manual calibrations menu, two options are possible:

F1 Flow zero gas

F2 Flow span gas

When zero or span gas is flowing, 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.

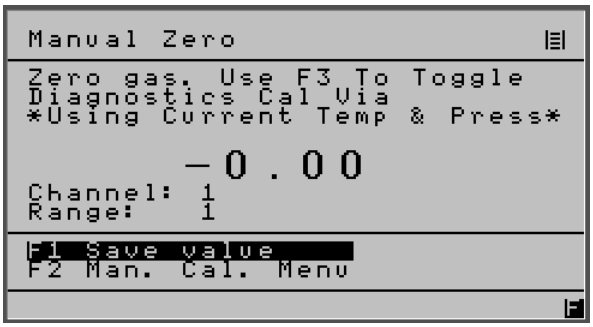


Figure 7-14 Manual zero calibration

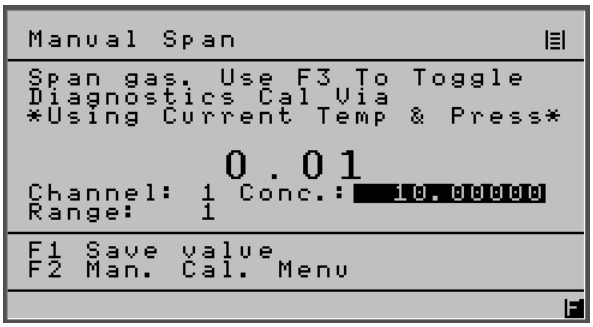


Figure 7-15 Manual span calibration

7.4.3. Display Deviations – from Calibration menu F3

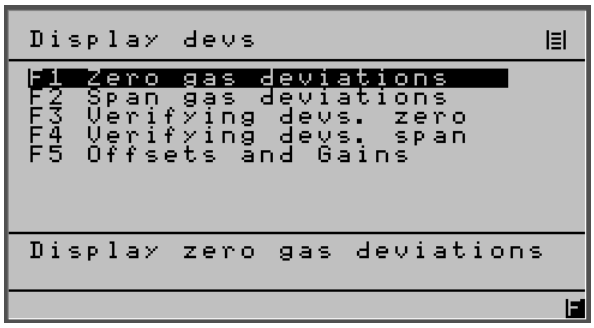


Figure 7-16 Display deviations

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

F1 Zero gas deviations

F2 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.

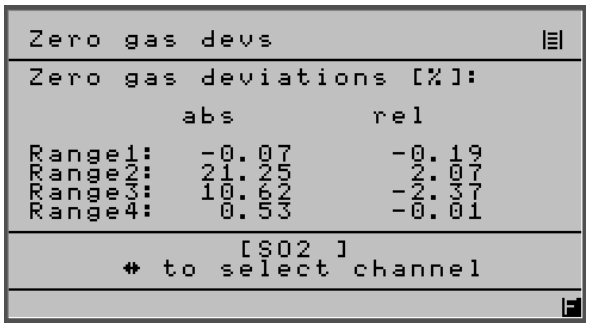


Figure 7-17 Zero gas deviations

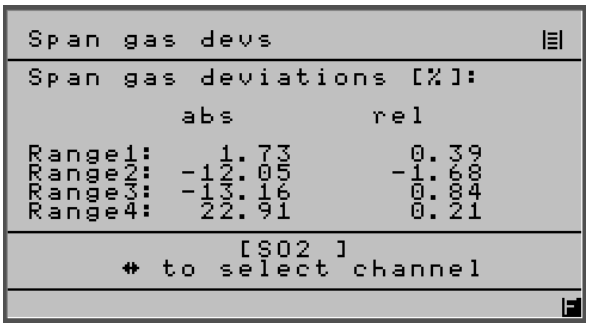


Figure 7-18 Span gas deviations

During calibration, there is 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 units of measurement. Relative deviation is the absolute average difference in percent, related to the range limit.

7.4.4. Absolute Zero Gas Deviation

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

7.4.5. 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.

7.4.6. Absolute Span Gas Deviation

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

7.4.7. 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.

7.4.8. F4 Check Calibration

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

7.4.9. F5 Reset Calibration Values

There is a default calibration. Pressing F5 calls a new screen that asks if the user is sure they wish 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. In addition, the linearization polynomial will be overwritten with the factory values.

7.4.10. 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 starts 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.

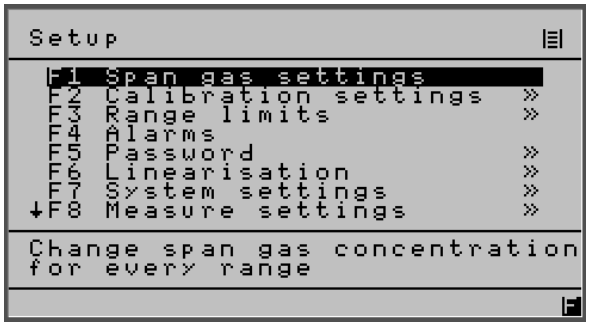


Figure 7-19 Setup menu screen I

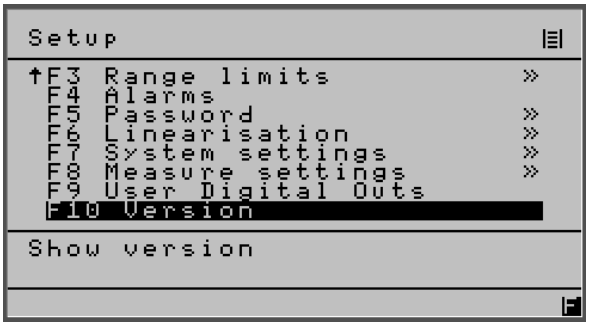


Figure 7-20 setup menu screen II

7.5.1. F1 Span Gas Concentration

Note: If you do not have a specific gas for a specific range, the calibration will use the previous ranges calibration. You must have a least one span gas.

For calibration, it is necessary to input the concentration of the span gas in units of measurement. 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 the range to change with the cursor buttons. 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 ended by pressing the Enter key again. Then the input cursor disappears and a new range can be selected. The changes are saved when 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.

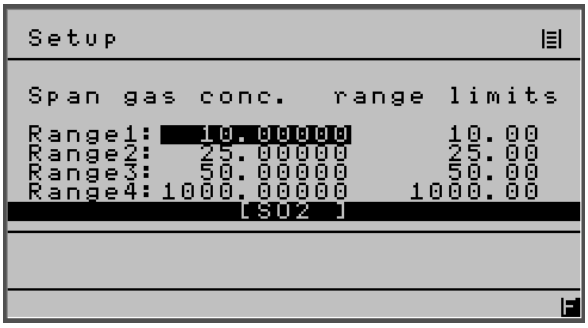


Figure 7-21 Change Span Gas Settings

7.5.2. Calibration Settings

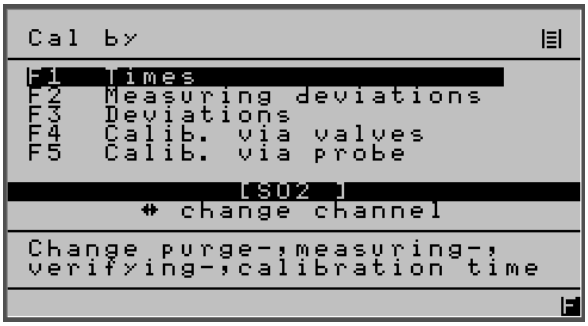


Figure 7-22 Change Auto Calibration Settings

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

7.5.3. F1 Times

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

7.5.4. F2 Measuring Deviations

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

7.5.5. F3 Deviations

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

7.5.6. F3 Range Limits

There are 4 different ranges. The user can define the upper range limits in units of measurement.

Figure 7-23 Change Range Limits

7.5.7. 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 reading in a range has reached 90% of the upper range limit in the auto range mode, the range is switched automatically to the next higher range.

Figure 7-24 Change Upper Range Limits

7.5.8. F2 Change Auto Range Limits

Although the auto range limits are set 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.

Figure 7-25 Change Auto Range Limits

7.5.9. 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.

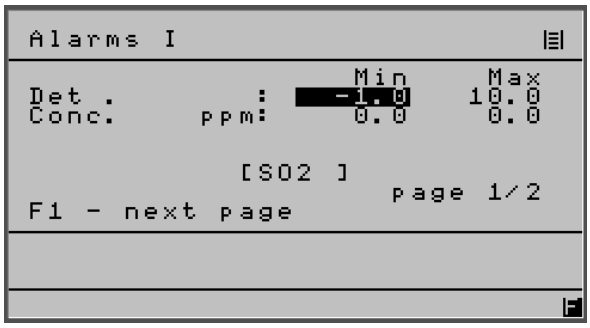


Figure 7-26 Alarm screen I

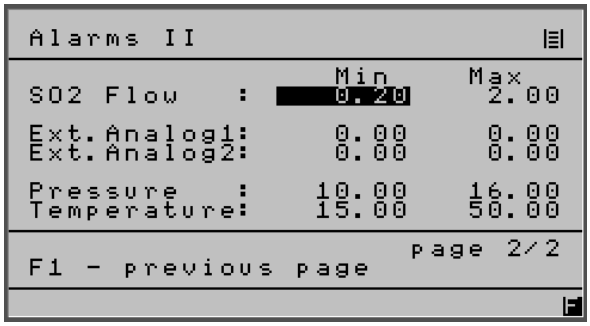


Figure 7-27 Alarm screen II

Set Temperature Alarms Set Concentration, Pressure and Voltage Alarms

7.5.10. 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:

Figure 7-28 Enter / Change Password

7.5.11. F1 Enter Password

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

Figure 7-29 Access Level Screen

F1 to F4 selects an access level. Move the cursor to the access level desired. You must enter the correct password for the access level desired. The passwords for the various operation levels consist of three numbers that must to 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.

7.5.12. 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!

7.5.13. F3 Reset Passwords

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

7.5.14. 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 and span corrected value, and the other value is the raw-value.

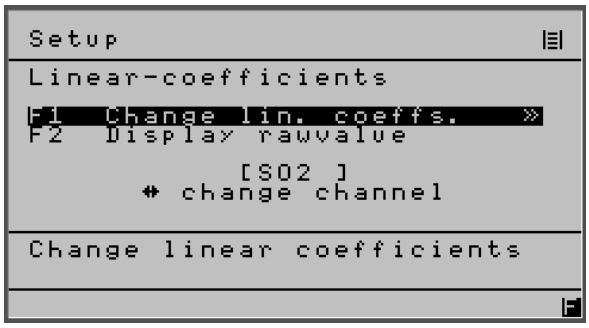


Figure 7-30 Linearization Screen

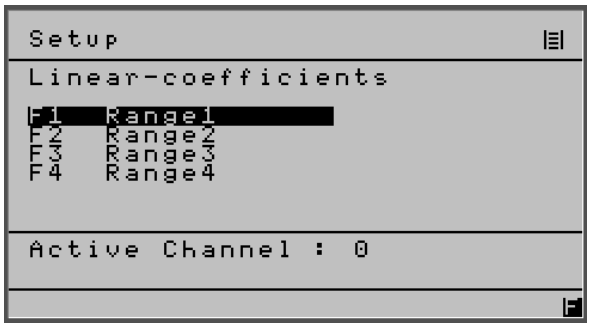


Figure 7-31 Coefficients Range Select

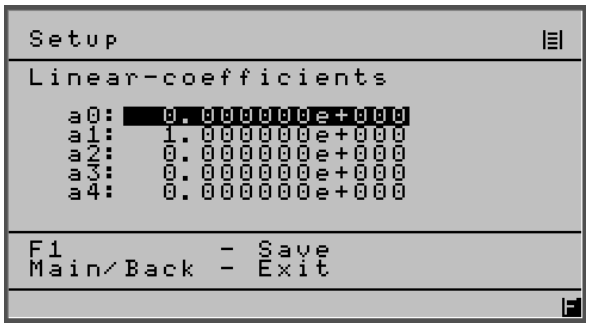


Figure 7-32 Change Coefficients

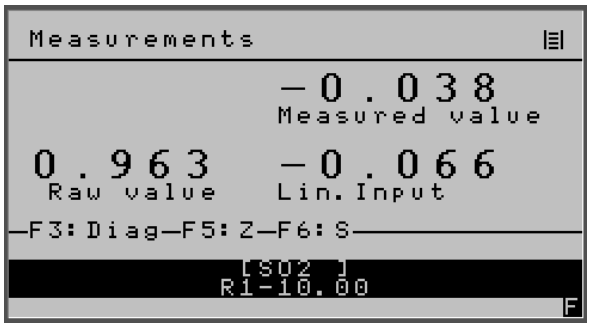


Figure 7-33 Linearized and raw data

7.6. F7 System Settings

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

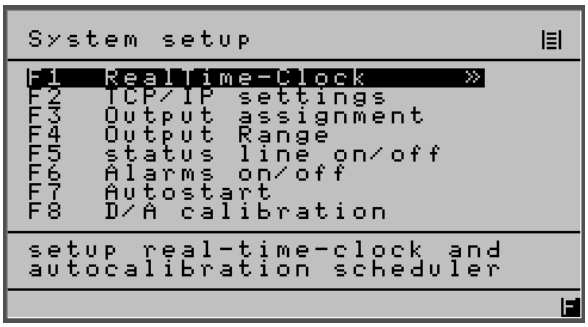


Figure 7-34 System Setup Screen

7.6.1. F1 Real Time Clock

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

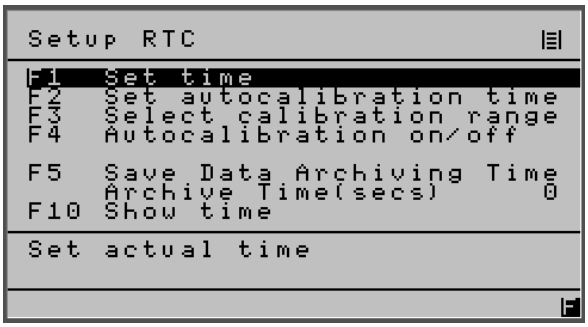


Figure 7-35 Clock and Timing Setup Screen

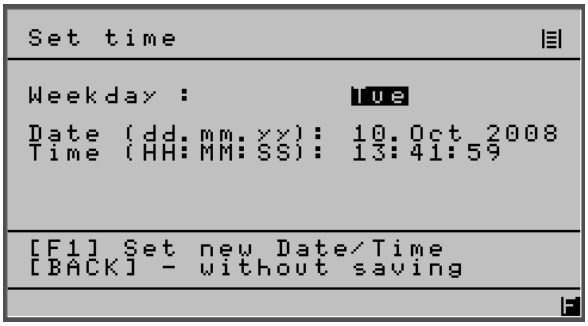


Figure 7-36 Clock set screen

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.

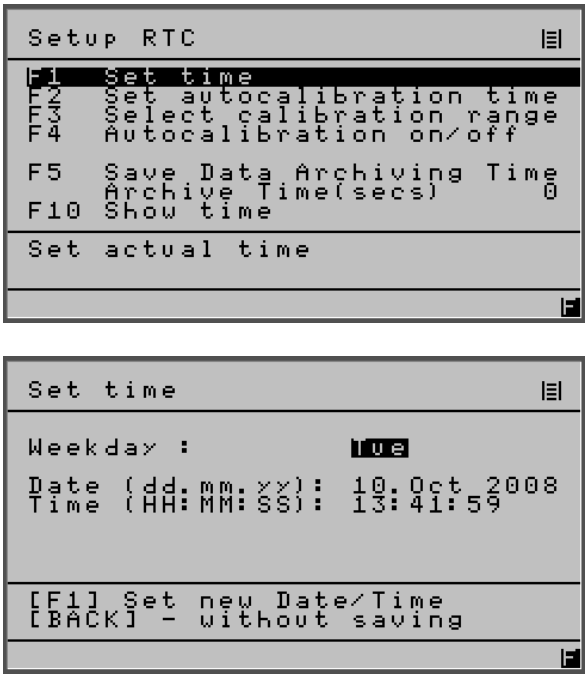


Figure 7-37 Set Real Time Clock

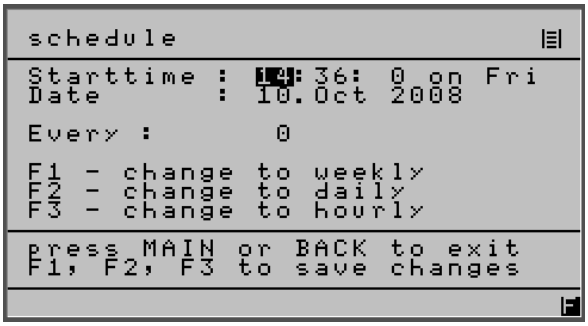


Figure 7-38 Set Auto Cal Timing

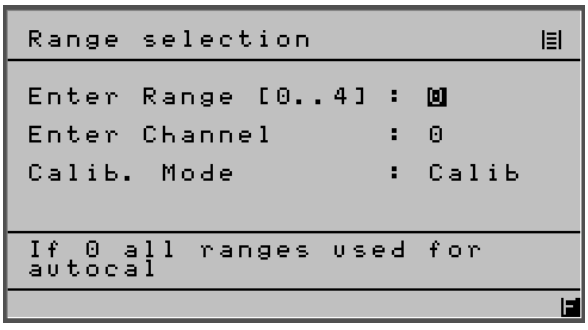


Figure 7-39 Set Auto Cal Ranges

7.6.2. System Setup F2 Displays TCP/IP Address

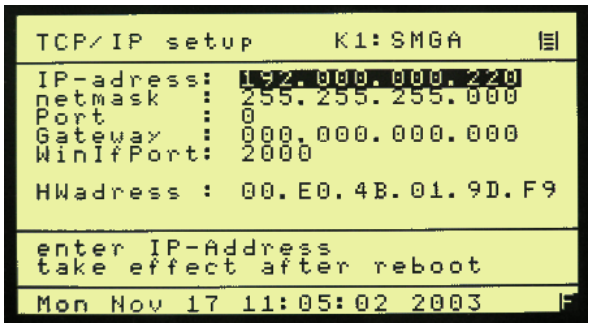


Figure 7-40 TCP/IP Address(NEW PIC PENDING)

7.6.3. Systems Setup F3 Displays Output Signal Assignments
(Used to Adjust Analog Output Channels)

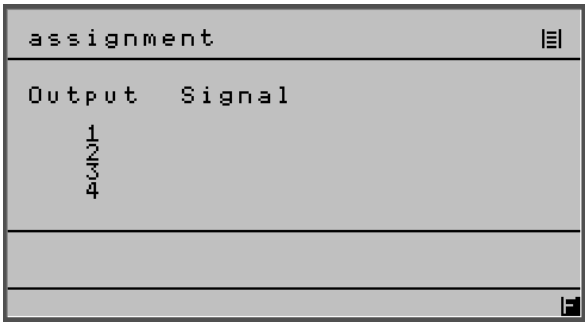


Figure 7-41 Output Assignments

7.6.4. System Setup F4 Displays Output Ranges
(Used to Adjust Scale of Analog Output Channels)

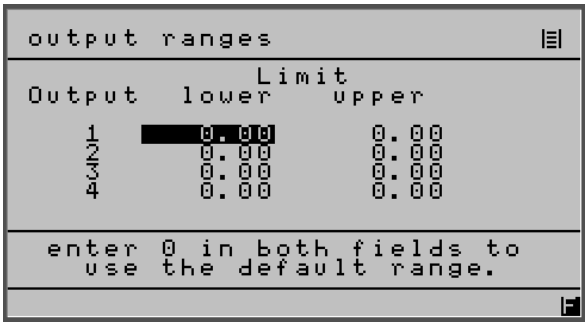


Figure 7-42 Output Ranges

7.6.5. F5 Turns Status Line On or Off

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

Figure 7-43 Status line

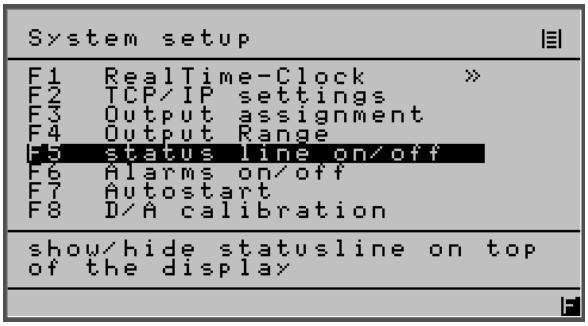


Figure 7-44Status line on/off

7.6.6. F8 Measure Settings

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

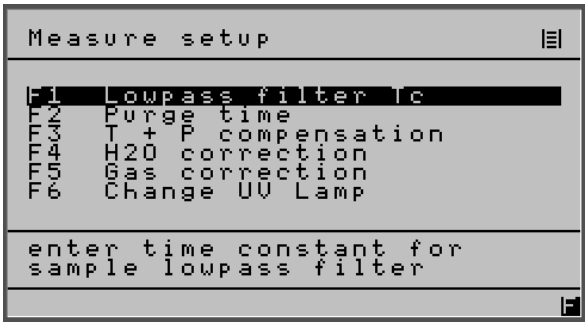


Figure 7-45 Measure setup

7.6.7. F1 Set Lowpass filter

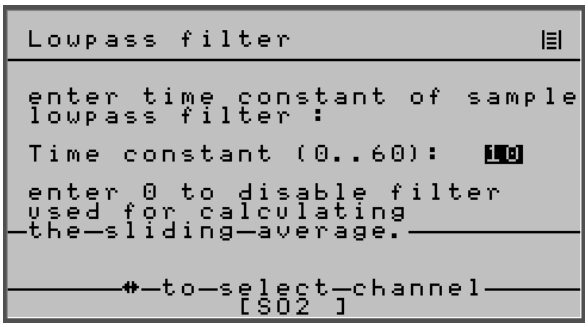


Figure 7-46 Lowpass filter

7.6.8. F2 Purge Time

F2 on the Menu Settings screen the sets the purge time before continuing with a zero or span calibration.

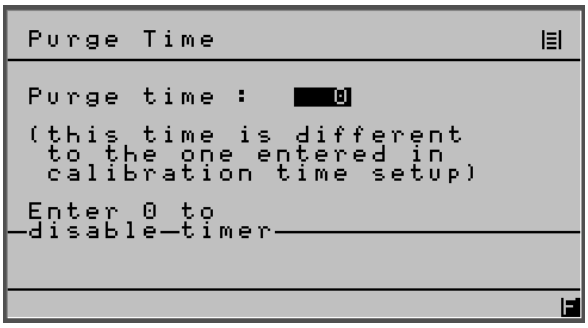


Figure 7-47 Purge Time

7.6.9. F3 Set Temperature and Pressure Compensation

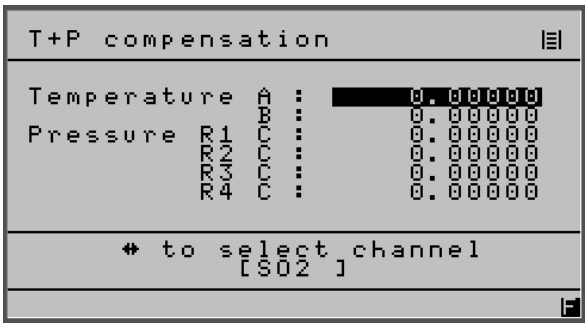


Figure 7-48 T +P compensation

7.6.10. F4 Water (Sample Humidity) Compensation

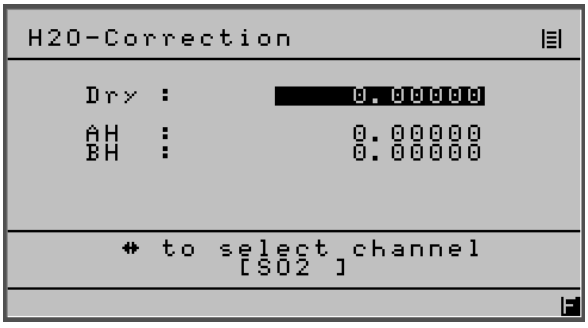


Figure 7-49 H_2O Compensation

7.6.11. 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.

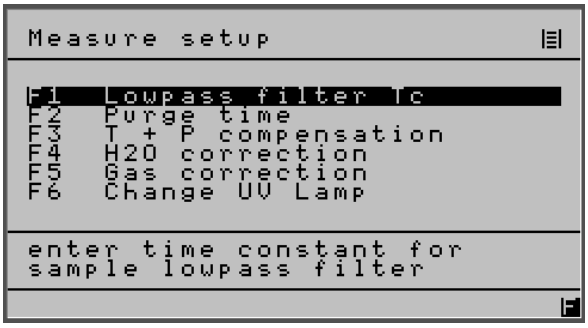


Figure 7-50 Low pass filter time constant

7.6.12. F10 Displays the Current Analyzer and Software Versions

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

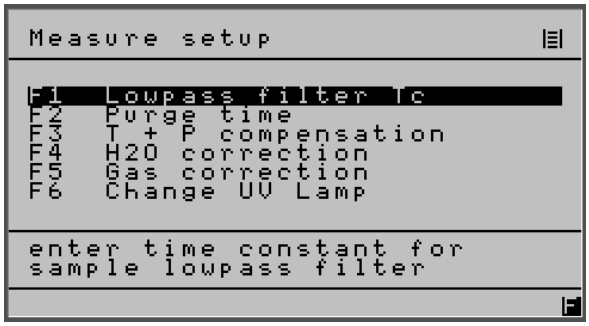


Figure 7-51 Analyzer Information

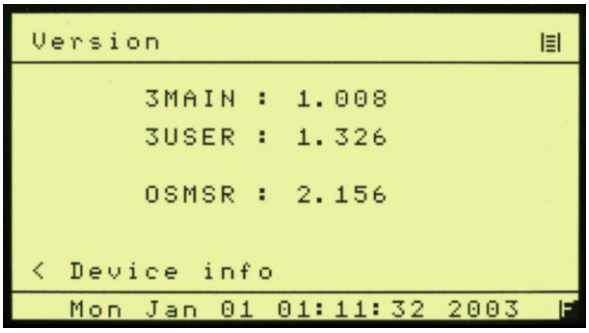


Figure 7-52 Software Version(NEW PIC PENDING)

7.7. F7 Remote / Manual Control

The analyzer can be remote-controlled either by 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.

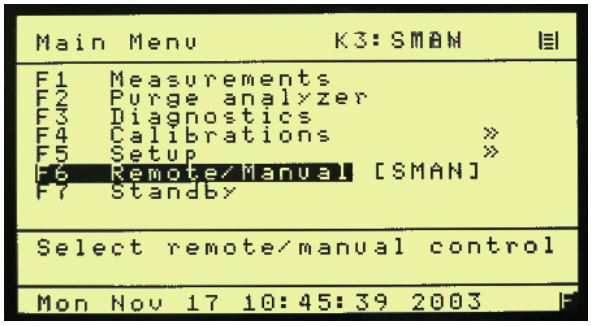


Figure 7-53 F6 Remote/Manual(NEW PIC PENDING)

Main Menu (User Level 4)

7.8. F8 Standby

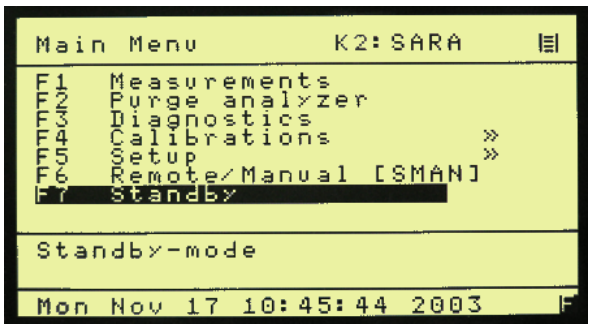


Figure 7-54 F7 Standby(NEW PIC PENDING)

Main Menu (User Level 4)

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

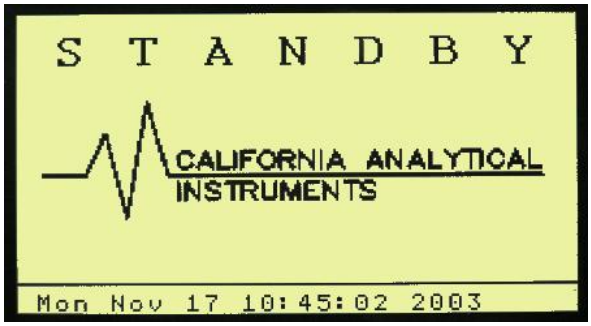


Figure 7-55 Standby Mode(NEW PIC PENDING)

TABLE OF CONTENTS

ADDENDUM

13.5 STARTING WITH SERIAL #U06081

13.5 Starting With Serial Number U06081

1.0 INTRODUCTION

The Model 600 SO_2 Series of instruments starting with Serial Number U06081 have several new Hardware and Software features.

The Hardware includes the use of a new memory system, isolation of the analog output signals and 15 relays that are used to buffer the many new digital output signals that are now available. **SEE TABLE D**

The available digital signals consist of a SERVICE group, which can be used to externally monitor a number of conditions for preventative maintenance and diagnostics.

A second STATUS group, is provided to define the operation of the instrument such as Spanning, Zeroing, Calibrating and the current Range (1, 2, 3, 4, AUTO)

Many of the various signals are duplicated because the instrument can consist two different channels.

The Software includes modifications to existing functions, changes to the Measurement screen, additional Short-Cut Keys and several New Functions that are listed as follows:

- **MEASUREMENT**

Over Range	**888888**
Diagnostics	**F3**
Zero	**F5**
Span	**F6**
Range Limits	**F8**
Span Values	**F9**
Outputs	**F10**

Note: The operator can use these Short-Cut Keys or continue to use existing procedures.

- **NEW FUNCTIONS**

Auto Startup	**F5, F7, F7**
ALARMS	**F5, F7**, (Use **F6** to toggle ON/OFF)
Offsets& Gains	**F4, F3, F5**
D/A Calibration	**F5, F7, F8**
Save Data Archiving Time	**F5, F7, F1, F5** (ENTER to change record time)
User Digital Outputs	**F5, F9**

- **Modifications**

Saved/Not good	**F4, F2, F1 or F2** (To flow Zero or Span Gas)
Re-Set Calibration Values	**F4, F5**

2.0 OPERATION OF MEASUREMENT KEYS

Note: USE the F1 & F2 Keys to view the complete list of menu items, from the MEASUREMENT screen

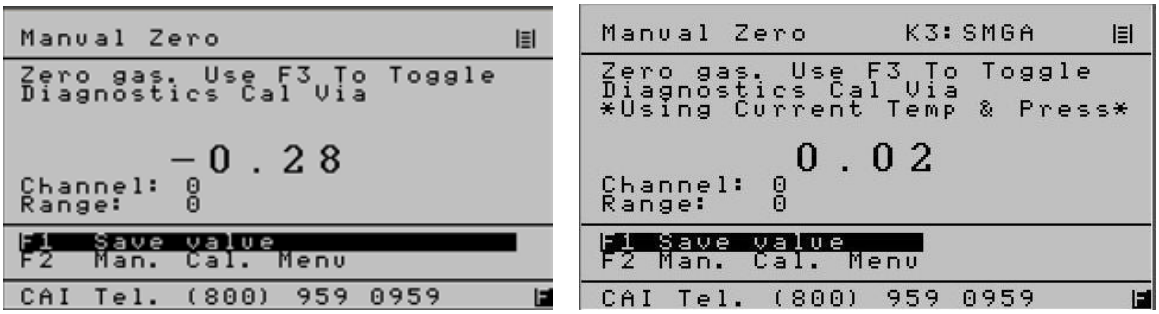
2.1 Over Range 888888

In the MEASUREMENT mode only, any value that exceeds the "range" by more than10% will be displayed as 888888.

2.2 Diagnostics Use **F3** to toggle between MEASUREMENT and DIAGNOSTIC

2.3 Zero: From the MEASUREMENT screen, select the required channel and range then press **F5.**

Note: For instruments with Zero Solenoid(s) select Calibration by Valves. **(Main, F5, F2, F4**)



2 Versions

Zero Gas will be enabled and the observed results can be used to evaluate instrument performance

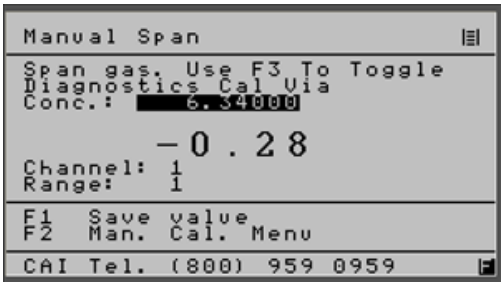
Press **F3** to toggle to the Diagnostic screen for additional information

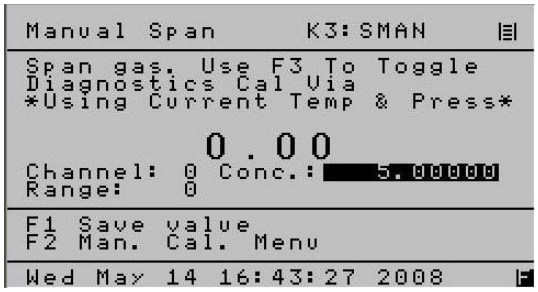
Press **F1** to save the value and complete a ZERO calibration for this channel and range.

Press **MAIN, F1** to return to the MEASUREMENT screen to select other channels and ranges and repeat the process or press **F2** to return to the Manual Calibration screen

2.4 Span: From the MEASUREMENT screen, select the required Channel and Range then press **F6.**

Note: For instruments with Span Solenoid(s) select Calibration by Valves **(Main, F5, F2, and F4**).





2 Versions

Span Gas for Channel1 and Range 1 will be enabled and the observed results can be used to evaluate instrument performance.

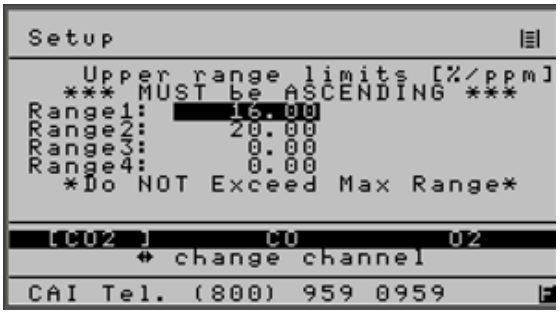
Press **F3** to toggle to the Diagnostic screen for additional information

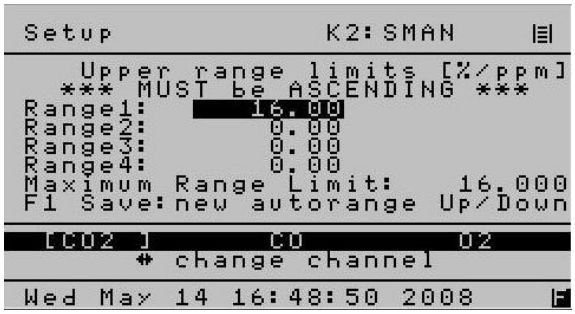
Press **F1** to save the new value and complete the SPAN calibration for this Channel and Range.

Note: The span gas value used for this channel and range is highlighted and can be changed if necessary. Use the Enter key and the numeric keys as required.

Press **MAIN, F1** to return to the MEASUREMENT screen to select other Channels and Ranges and repeat the process or **F2** to return to the Manual Calibration screen.

2.5 Range Limits: (F8) From the MEASUREMENT screen;



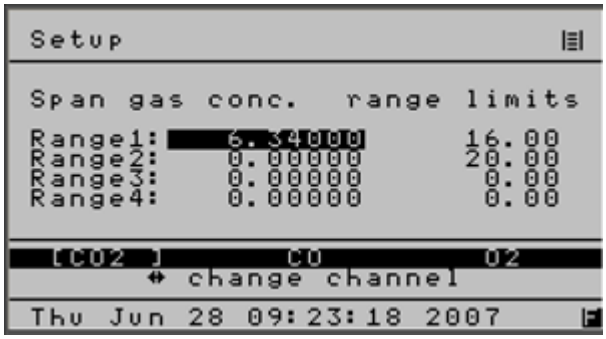


2 Versions.

The Channels and Ranges are factory defined and application specific. Consult California Analytical if any changes are required.

Use the ← → keys to observe the other Channels.

2.6 Span Values: F9 From the MEASUREMENT screen

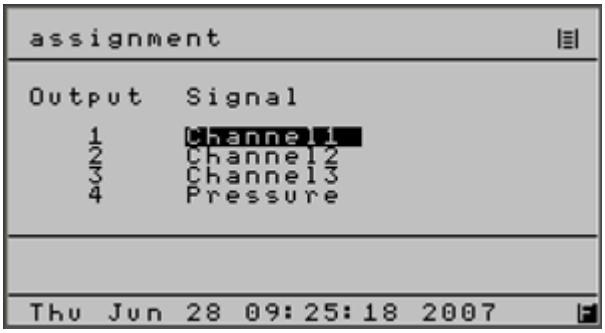


Use the ← → keys to select the desired Channel and the ↕ to select the Range

Note: The span gas value used for this channel and range is highlighted and can be changed if necessary.

Use the **Enter** key and the **NUMERIC** keys as required.

2.7 Outputs: **F10 From the MEASUREMENT screen**



Use this screen to define the signals and their location that will be monitored by a remote reordering device.

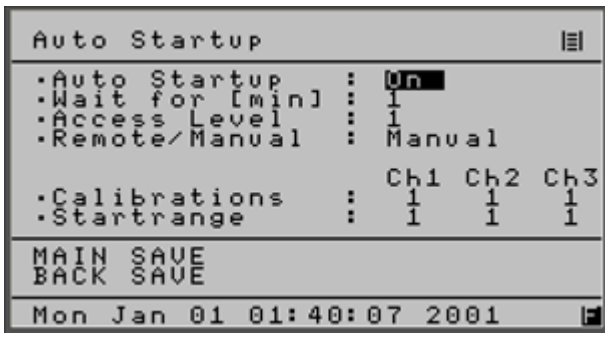
Use the ↕ to select the desired Output. Press Enter to select
Use the ↕ to select the desired Signal. Press Enter to select

Use this screen to define the signals and their location that will be monitored by a remote reordering device.

SEE TABLE D

3.0 NEW FUNCTIONS

3.1 Auto Start Up: (Main, F5, F7, F7)



All key analyzer parameters are stored in a secure memory location and retained when power is removed
In the event of an unexpected power failure it may be desirable to change some parameters until an operator can resume control.

This screen may be used to establish several desirable special instrument start-up parameters that define how the analyzer recovers from loss of AC power

When enabled this screen will define the following:

Wait: The time delay in minutes before proceeding. If **zero** is selected the instrument will not start until all temperature warnings are cleared

Calibrations: The number of attempts to complete a successful calibration as required in the operator defined Deviation Tables.
If calibration is not successful the instrument will continue reporting results using the last completed calibration.
The analyzer can be configured use the previous calibration by selecting zero Calibrations.

Starting Range: When all defined actions are completed the analyzer will return to the Measurement Screen and to the range specified.

Access Level: The user level at Start Up

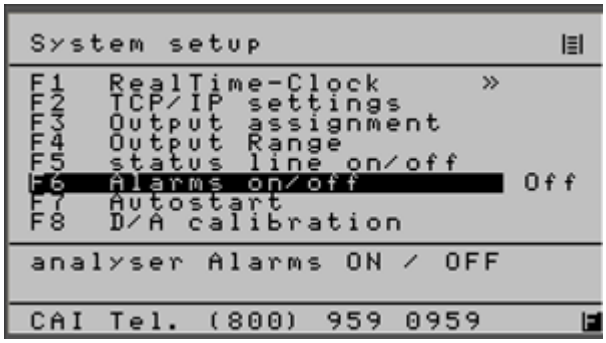
Remote/Manual: Put the analyzer in either “Remote” or “Manual” at Start Up

3.2 Alarms On/Off: (Main, F5, F7)

All key analyzer parameters are stored in a secure memory location and retained when power is removed. In the event of an unexpected power failure it may be desirable to change some parameters until an operator can resume control.

This screen may be used to establish several desirable special instrument start-up parameters that define how the analyzer recovers from loss of AC power.

When enabled this screen will define the following…

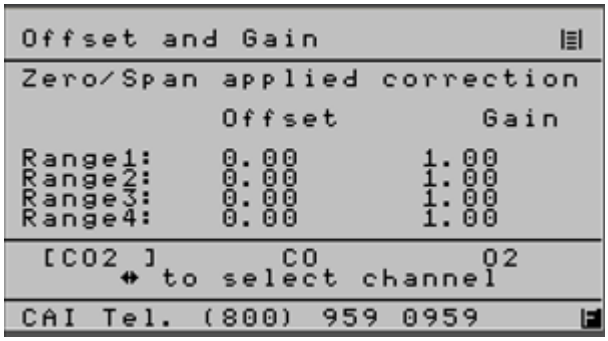


Use **F6** to toggle ON/OFF

The instrument has an extensive library of error messages that will aid in the identification of various anomalous events and are displayed at the bottom of the screen. These messages will assist in Diagnostics and indicating the need for preventative maintenance

This screen provides an **option** to disable these messages during initial start- up or as may be desired for a particular application.

3.3 Offset & Gain (Main, F4, F3, F5)



This screen can be used to provide an additional means to display calibration deviations.

Use ← → keys to change channel.

The OFFSET is the value stored during zero calibration.

The GAIN is the value stored during span gas calibration using the operator defined calibration gas.

An increasing or decreasing change to the OFFSET or GAIN when used in conjunction with “Deviations” will provide insight to both short and long term changes to system performance

3.4 Calibrate The Analog Outputs: **Main, F5, F7, F8** D/A Calibration
Main, F5, F7, F3 Output Assignment

- **Overview**

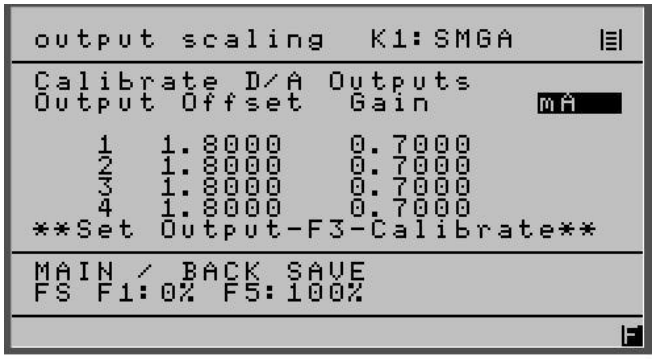
The 600 SO_2 Series of instruments are designed to provide analog outputs that can be configured as 0-1 VDC, 0-5 VDC, 0-10 VDC, 4-20 mA, or 0-20 mA.

With this version the outputs can also be configured to include an additional 1.0 volt and 5.0 volt output and a **calibration** capability.

The outputs can be calibrated to exactly match the results obtained on a PLC, Recorder, Data Logger or other remote recording device that may be connected to the analyzer.

The operator will first select the **OUTPUT ASSIGNMENT (Main, F5, F7, F3)** screen and choose the output that is to be calibrated. By selecting “calibrate” as the output all outputs of interest may be selected. When calibration is competed, the operator will return the outputs to their original assignment

The D-A CALIBRATION screen will then be used to complete the calibration procedure.



This screen provides a section that is used to record the zero signal corrections (zero offset) and a second area to record the 100% signal corrections (Gain) for each of the four output signals that may be defined to develop a voltage or current signal..

Since this is a Digital to Analog conversion, the calibration will require the completion of a simple “trial and error” procedure. The operator will observe the results of a “zero” or “span” (Gain) signal generated by the analyzer to the remote recording device and select a correction factor The operator will save this value and then observe the results on attached the remote recording device.

The process of selection and saving for “zero” and “span” will be repeated until a satisfactory calibration is achieved. For 0-1VDC, 0-5VDC, 0-10VDC and a 0-20 mA outputs the Offset and Gain values are independent and do not interact. With the 4-20 ma output, the Offset “zero” and Gain “span” values interact and may require a few more trials.

The following is a table of typical values:

OUTPUT	OFFSET	GAIN
0-20 ma	0.000	0.927
4-20 ma	1.820	0.740
0-1 V	1.300	0.820
0-5 V	1.100	0.820
0-10 V	1.050	0.820

- **Procedure**

3.4.1 From the Main Menu press **F5, F7, F3, to** obtain following screen:

Main, F5, F7, F3

3.4.2 Use the ↕ to highlight the outputs that require calibration.

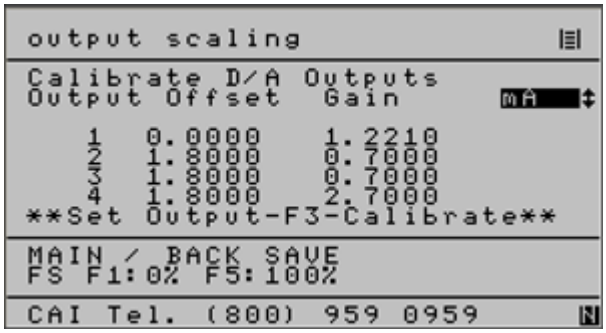
3.4.3 Press enter to provide access to all the menu of signals that are available. (Real Time). Channel 1, Channel 2, Calibration, Sample pressure, etc.)

3.4.4 Select Calibration and press **ENTER** to complete the selection

Note: Any or all of the four outputs can be selected for calibration
This screen will not be used again until calibration has been completed.

3.4.5 Press **BACK** to return to the SYSTEM SETUP screen (**F5, F7** from the main menu)

3.4.6 Press **F8** to obtain the following screen:



MAIN, F5, F7, F8

3.4.7 Use the ↕ to select the desired output press **ENTER**

3.4.8 Press F1 to select a ZERO signal and observe the results on the remote device

3.4.9 Change the offset value press **BACK** to save the new value.

3.4.10 Press **F8** to return to the D-A Calibration screen and note the results on the remote device.

3.4.11 Repeat steps **3.4.8** thru **3.4.10** until a satisfactory ZERO calibration is achieved.

3.4.12 Complete steps **3.4.8** thru **3.4.10** for each of the remaining outputs that require calibration.

3.4.13 Press **F5** to produce a full scale (100%) signal

3.4.14 Use the arrow keys to position the curser at the require GAIN value

3.4.15 Observe the results on the remote device and make a correction to the GAIN value for the output of interest. Press **BACK** to save this new value

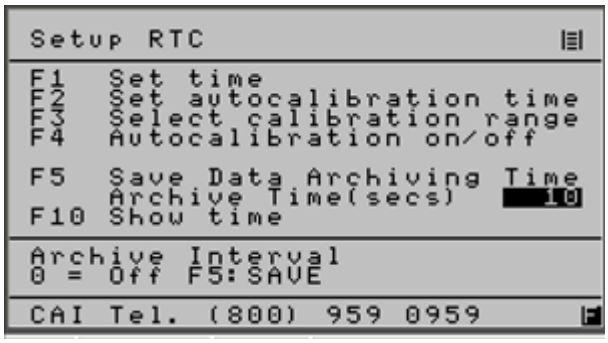
3.4.16 Press **F8** to return to the D-A calibration screen

3.4.17 Observe the results on the remote device and repeat steps change the GAIN value by repeating steps **3.4.14** thru **3.4.16** as needed for each output.

3.4.18 Return to the OUTPUT Assignment screen **F5, F7, F3** from the main menu and change the output signals from CALIBRATE to their original values as defined in step **3.4.1.**

3.5 Save Data Archiving Time (F5, F7, F1, F5)

Archive Time is the Time in seconds between each set of data points. If “zero” no data is stored in the SEC data files. The SEC data files are in .CSV format for direct import into Excel. CAI can provide the tools necessary to download these files.



Use ENTER to change recording time

SEE TABLE A

TABLE A

600 SERIES SO_2 DATA ARCHIVE FILES

Time,
Date,
Month,
Year,
Error Index,
TimeStamp,
Pressure,
Temperature,

Name,
Concentration,
Detector Volts,
Range,
Auto / Manual,
Span Value,
Offset,
Gain,
Sample Pressure,
Sample Flow,
Sample EPC Volts,
Detector Temperature,
Meas Mode,
Local / Remote,

If 2 Channel this data is added
Name,
Concentration,
Detector Volts,
Range,
Auto / Manual,
Span Value,
Offset,
Gain,
Sample Pressure,
Sample Flow,
Sample EPC Volts,
Detector Temperature,
Meas Mode,
Local / Remote,

3.6 User Digital Outputs

- **Overview**

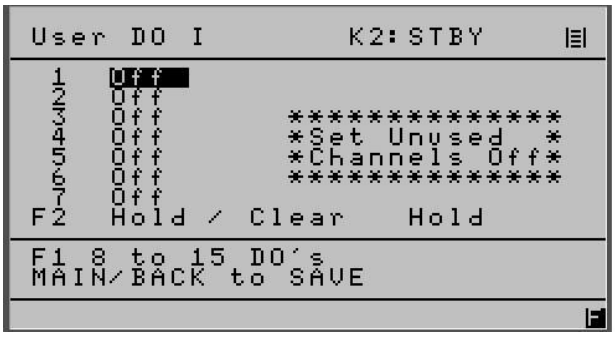
  The 600 SO_2 Series of instruments have 15 solid state, optically coupled, isolated relays that can be programmed by the operator to indicate the status of numerous signals.

  The available digital signals consist of a SERVICE Group that can be used to externally monitor a number of conditions to aid in preventative maintenance and diagnostics. **SEE TABLE B & D**

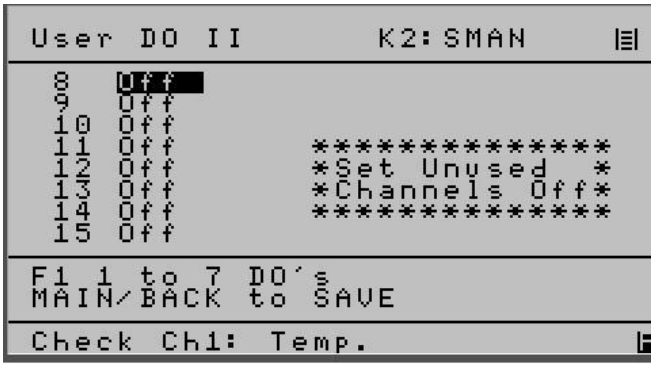
  A second STATUS group is provided and is used to define the operation pf the instrument such as Spanning, Zeroing, Calibrating, and the current Range (1, 2, 3, 4 AUTO) etc. **SEE TABLE C & D**

  The individual output signals can be operator selected and set to a **HOLD** or **CLEAR** mode.

  In the **HOLD** mode an activated signal is retained until the operator returns to the **Digital Output Screen** and selects the appropriate output signal and performs a manual CLEAR. After performing a Clear Operation, the operator must press **F2** again to put the outputs back onto **HOLD** mode.



  In the **Clear** Mode the signal will automatically change when the microprocessor detects that the noted condition no longer exists.



The operator can select from the following the desired **SERVICE** or **STATUS** groups that are to be digitally monitored.

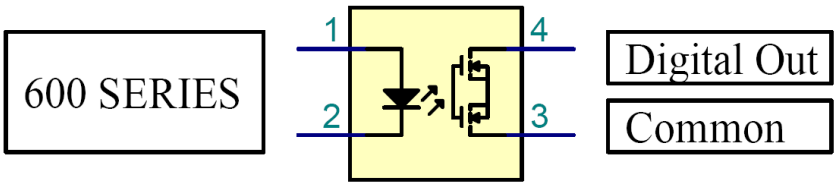
TABLE B

Index	Service Group	User DO Screen Display
0		
1	Flow 1 Failure	F1
2	Flow 2 Failure	F2
3	Flow 3 Failure	F3
4	Extern Analog 1 Failure	E1
5	Extern Analog 2 Failure	E2
6	Pressure Failure	P
7	Temperature Failure	T
8	Channel 1 is not calibrated	1NC
9	Channel 2 is not calibrated	2NC
10	Channel 3 is not calibrated	3NC
11	Ch1: Low conc. Warning	1LoC
12	Ch2: Low conc. Warning	2LoC
13	Ch3: Low conc. Warning	3LoC
14	Ch1: High conc. Warning	1HiC
15	Ch2: High conc. Warning	2HiC
16	Ch3: High conc. Warning	3HiC
17	Ch1: Temperature!	1DT
18	Ch2: Temperature!	2DT
19	Ch3: Temperature!	3DT
20	Ch1: EPC failure	1EV
21	Ch2: EPC failure	2EV
22	Ch3: EPC failure	3EV
23	Ch1: Range overflow	1OR
24	Ch2: Range overflow	2OR
25	Ch3: Range overflow	3OR
26	Ch1: ADC Range Overflow	1AU
27	Ch2: ADC Range Overflow	2AU
28	Ch3: ADC Range Overflow	3AU
29	Ch1: ADC Range Underflow	1AO
30	Ch2: ADC Range Underflow	2AO
31	Ch3: ADC Range Underflow	3AO
32	dummy text for RTC	Off
33	General Alarm	G
35	1 Cal Alarm	1CA
36	2 Cal Alarm	2CA
37	3 Cal Alarm	3CA
34	In Remote	R

TABLE C

Index	STATUS GROUP	User DO Screen Display
38	1 AutoRange	1AR
39	1 Range 1	1R1
40	1 Range 2	1R2
41	1 Range 3	1R3
42	1 Range 4	1R4
43	1 In Calibrate	1C
44	1 In Zero	1Z
45	1 In Span	1S
46	1 In Sample	1Sa
47	2 Auto Range	2AR
48	2 Range 1	2R1
49	2 Range 2	2R2
50	2 Range 3	2R3
51	2 Range 4	2R4
52	2 In Calibrate	2C
53	2 In Zero	2Z
54	2 In Span	2S
55	2 In Sample	2Sa
56	3 Auto Range	3AR
57	3 Range 1	3R1
58	3 Range 2	3R2
59	3 Range 3	3R3
60	3 Range 4	3R4
61	3 In Calibrate	3C
62	3 In Zero	3Z
63	3 In Span	3S
64	3 In Sample	3Sa

Typical Relay

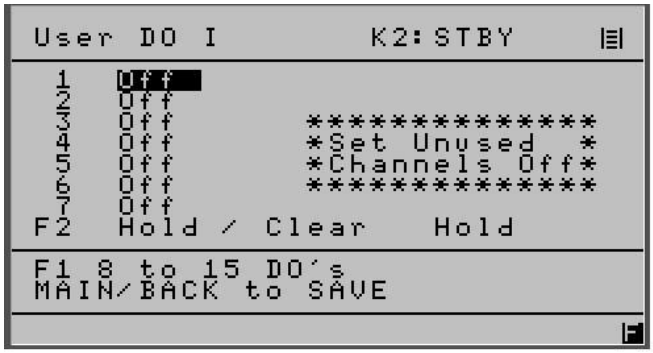


These contacts (3, 4) will drive continuously up to 500 MA using a customer voltage supply that does not to exceed 60 VDC.

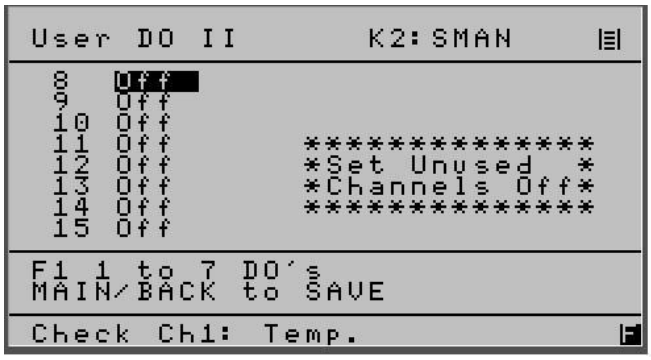
- **Operation**

  Use **(Main, F5, F9)** to select the first eight outputs
  Use the ↕ to select the desired output
  Press ENTER and use ↕ to select desired item
  Press ENTER to save selection

  NOTE: The 600 SO_2 has 14 user selectable isolated digital outputs from the list of 64 in **TABLE B & C**



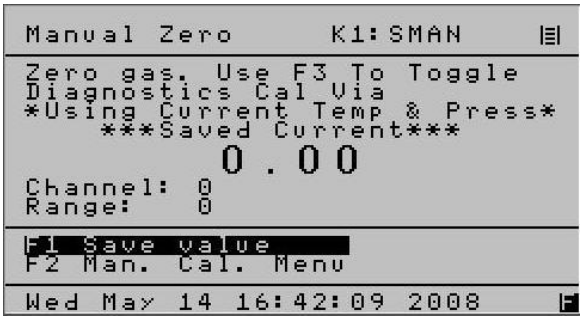
Press **F1** to observe the remaining seven outputs
Program as desired per the above

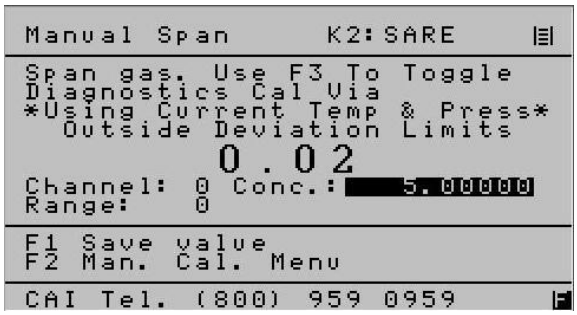


4.0 CHANGES TO EXISTING FUNCTIONS

4.1 Saved or Outside Limits

During Manual Calibration the following screens will be displayed to indicate the instruments response to the value of the zero or span gas using the amount that the operator defined in the deviation table.





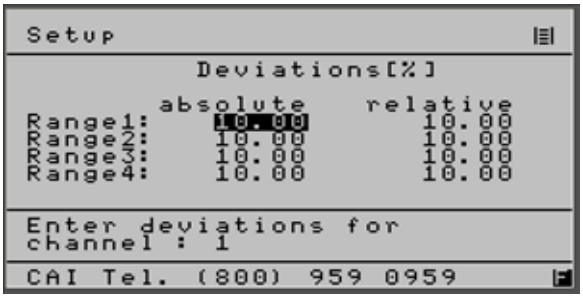
The Above is shown using Zero and Span Cal

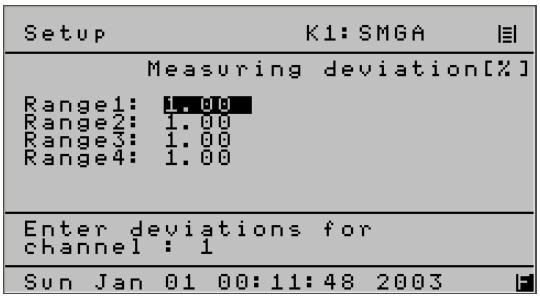
From Measurement use: **F5 "zero"** or **F6 "span"**

From Main Menu use: **F4, F2, F1 "zero"** or **F2 "span"**

4.2 Calibration Deviations.

MAIN, F5, F2, F2 Deviations, F3 Measuring Deviations.

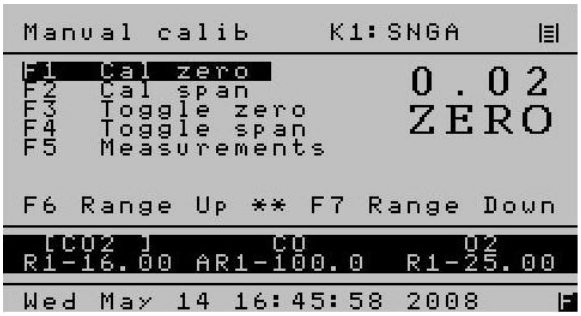


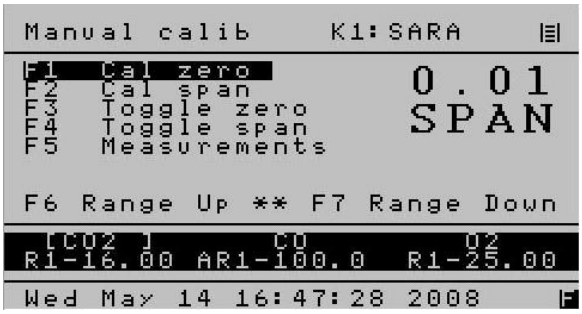


Note: These screens are used by the operator to define the maximum acceptable limits of the Zero and Span gas for both Manual and Automatic Calibrating.

4.3 Flow Zero or Span

Some analyzers have the above and the ability to flow Zero and Span Gas.



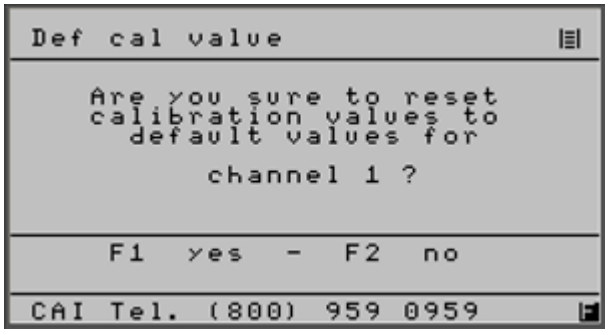


The above is shown using Zero/SPAN Gas

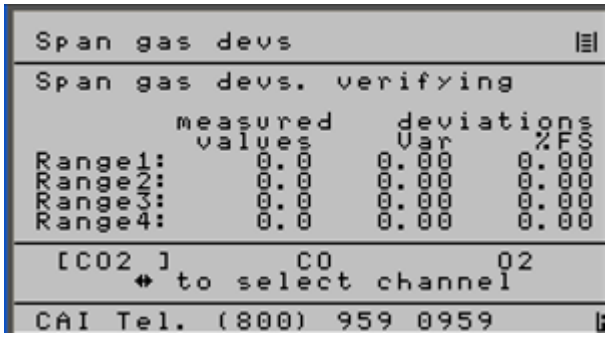
From Cal Screen use: **F2** or **Main** or **Back**
From Main Menu use: **F4, F2**

4.4 Reset Calibration Values

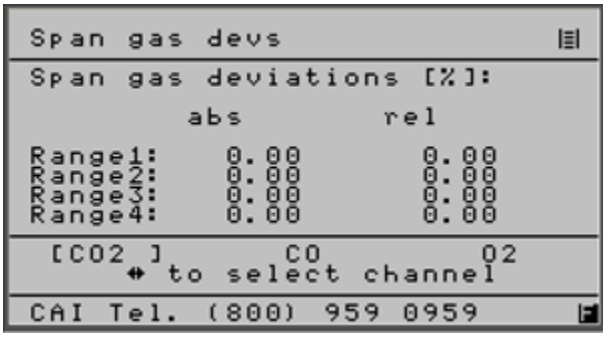
When the re-set calibrations value function is used all recorded deviations will be set to zero



MAIN, F4, F5



Main, F4 F3, F4
(Used to observe Auto Cal Results)



Main, F4, F3, F2
(Used to observe Manual Cal results)

The above are the new deviations after the operator elects to re-set the calibration values

TABLE D

600 SO_2 SERIES I/O CHART

28 PIN MAIN CONNECTOR ASSIGNMENTS

AO = Analog Output, OC= Open Collector, SV = Solenoid Valve TTL = Transistor Logic

OPTO I/0	Signal Type	601 Analog	602 Analog	603 Analog	Levels
ALG 1		pin #	pin #	pin #	
COM	A Output	1 **GND (Isolated analog)**	1 **GND (Isolated analog)**	1 **GND (Isolated analog)**	**Isolated AI**
0	A Output	2 **User Defined AO-1**	2 **User Defined AO-1**	2 **User Defined AO-1**	1v,5v,10v,mA
1	A Output	3 **User Defined AO-2**	3 **User Defined AO-2**	3 **User Defined AO-2**	1v,5v,10v,mA
2	A Output	4 **User Defined AO-3**	4 **User Defined AO-3**	4 **User Defined AO-3**	1v,5v,10v,mA
3	A Output	5 **User Defined AO-4**	5 **User Defined AO-4**	5 **User Defined AO-4**	1v,5v,10v,mA
DIG 1		**Digital**	**Digital**	**Digital**	
COM	D Output	6 GND (Digital)	6 GND (Digital)	6 GND (Digital)	
0	D Output	7 Sense Auto Range	7 Sense Auto Range	7 Sense Auto Range	TTL-low true
1	D Output	8 Sense Range 1	8 Sense Range 1	8 Sense Range 1	TTL-low true
2	D Output	9 Sense Range 2	9 Sense Range 2	9 Sense Range 2	TTL-low true
3	D Output	10 Sense Range 3	10 Sense Range 3	10 Sense Range 3	TTL-low true
4	D Output	11 Sense Range 4	11 Sense Range 4	11 Sense Range 4	TTL-low true
5	D Input	12 Set Auto Range	12 Set Auto Range	12 Set Auto Range	
6	D Input	13 Control Range 1	13 Control Range 1	13 Control Range 1	
7	D Input	14 Control Range 2	14 Control Range 2	14 Control Range 2	
8	D Input	15 Control Range 3	15 Control Range 3	15 Control Range 3	
9	D Input	16 Control Range 4	16 Control Range 4	16 Control Range 4	
10	D Input	17 Auto Cal	17 Auto Cal	17 Auto Cal	
11	D Input	18 Calibrate	18 Calibrate	18 Calibrate	
12	D Input	19 Zero	19 Zero	19 Zero	
13	D Input	20 Span	20 Span	20 Span	
14	D Input	21 Sample	21 Sample	21 Sample	
15	SPARE				
DIG 2					
0	D Output	22 Zero Gas Flow	22 Zero Gas Flow	22 Zero Gas Flow	**OC (24vdc if internal SV)**
1	D Output	23 Span Gas Flow	23 Span Gas Flow	23 Span Gas Flow	**OC (24vdc if internal SV)**
2	D Output	24 Sample Gas Flow	24 Sample Gas Flow	24 Sample Gas Flow	**OC (24vdc if internal SV)**
3	D Output	25 Local/Remote	25 Local/Remote	25 Local/Remote	TTL-low true
4	D Output	26 Read Cal Mode	26 Read Cal Mode	26 Read Cal Mode	TTL-low true
5	D Output	27 Reserved	27 Reserved	27 Reserved	
6	D Output	28 Reserved	28 Reserved	28 Reserved	

TABLE D
600 SO_2 SERIES I/O CHART

28 PIN AUXILLARY CONNECTOR ASSIGNMENTS

OPTO I/O	Signal Type	601/602/603 Analog			LEVELS
ALG 1	Spare	pin #			
COM	A Input	1	GND (analog)		
4	A Input	2	External Analog 1		0-10V
5	A Input	3	External Analog 2		0-10V
6	A Output	4	**GND (Isolated analog)**		
7	D Output	5	**Relay RTN 1**		**9,10,11,12 use RTN 1**
DIG 3	**Alarms**	**Digital**			**Alarms go OPEN when present Status go CLOSED when active**
COM	D Output	6	**Relay RTN 2**		**13,14,15,16 use RTN 2**
0	D Output	7	**Relay RTN 3**		**17,17,19,20 use RTN 3**
1	D Output	8	**Relay RTN 4**		**21,2728 use RTN 4**
2	D Output	9	**User Defined NO Relay 1**		
3	D Output	10	**User Defined NO Relay 2**		
4	D Output	11	**User Defined NO Relay 3**		
5	D Output	12	**User Defined NO Relay 4**		
6	D Output	13	**User Defined NO Relay 5**		
7	D Output	14	**User Defined NO Relay 6**		
8	D Output	15	**User Defined NO Relay 7**		
9	D Output	16	**User Defined NO Relay 8**		
10	D Output	17	**User Defined NO Relay 9**		
11	D Output	18	**User Defined NO Relay 10**		
12	D Output	19	**User Defined NO Relay 11**		
13	D Output	20	**User Defined NO Relay 12**		
14	D Output	21	**User Defined NO Relay 13**		
15	D Output	22	**Reserved Do Not Connect**		
DIG 2					
7	D Input	23	Spare		
8	D Input	24	Spare		
9	D Input	25	Spare		
10	D Input	26	**Set Remote**		
11	D Output	27	**User Defined NO Relay 14**		
12	D Output	28	**User Defined NO Relay 15**		