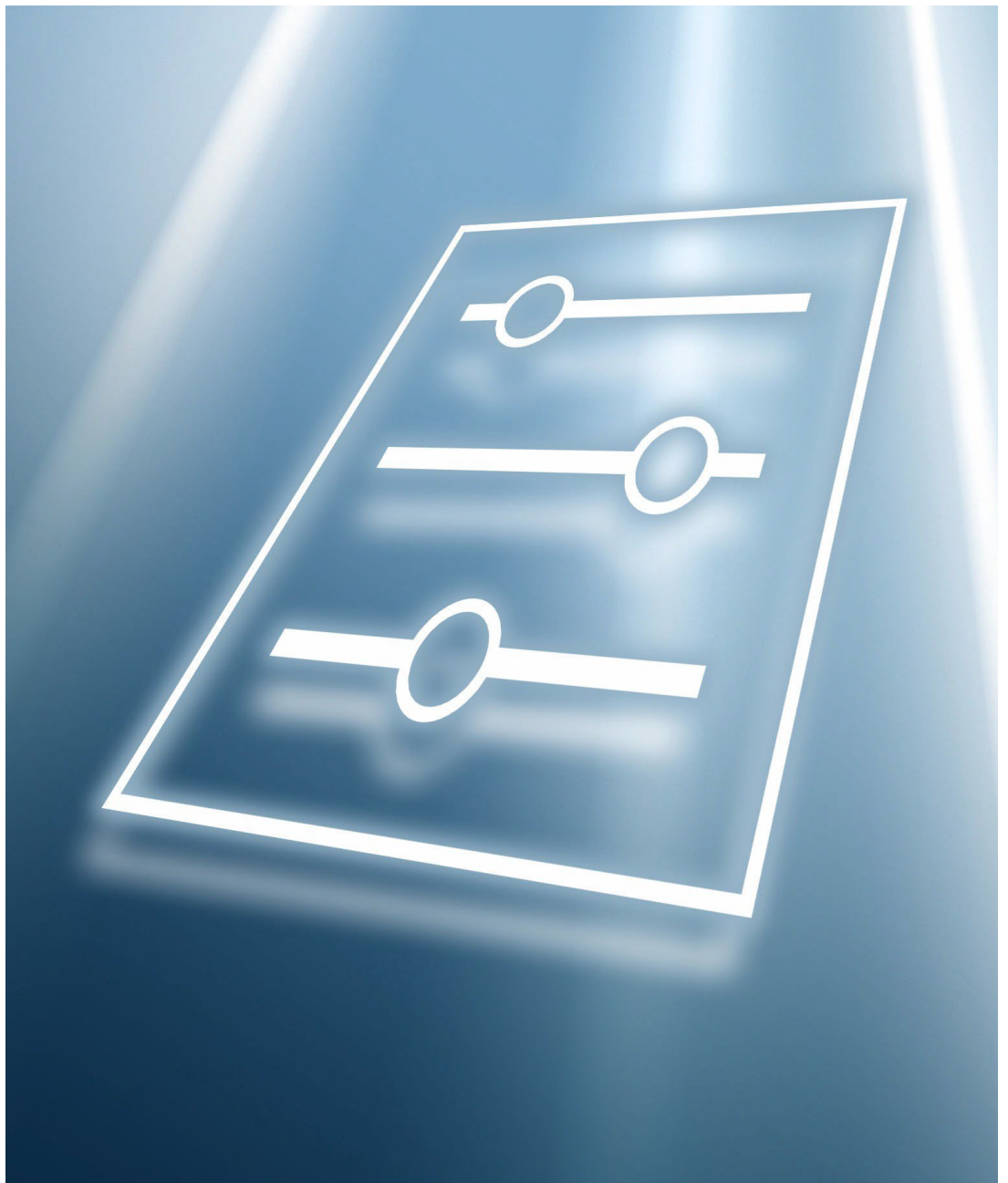


# Description of device parameters

## **NS 5.14 Firmware**







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# 1 About this document

## 1.1 Warnings

| Structure of Information  | Meaning  |
|---|--|
|  <b>WARNING</b><br>Causes (/consequences)<br>Consequences of non-compliance (if applicable)<br>▶ Corrective action | This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation can result in a fatal or serious injury. |
|  <b>CAUTION</b><br>Causes (/consequences)<br>Consequences of non-compliance (if applicable)<br>▶ Corrective action | This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or more serious injuries.     |
| <b>NOTICE</b><br>Cause/situation<br>Consequences of non-compliance (if applicable)<br>▶ Action/note   | This symbol alerts you to situations which may result in damage to property.   |

## 1.2 Symbols on the device

| Symbol  | Meaning  |
|---|--|
|  | The Laser Radiation symbol is used to alert the user to the danger of exposure to hazardous visible laser radiation when using the J22 or JT33 TDLAS Gas Analyzer.   |
|  | The High Voltage symbol that alerts people to the presence of electric potential large enough to cause injury or damage. In certain industries, high voltage refers to voltage above a certain threshold. Equipment and conductors that carry high voltage warrant special safety requirements and procedures. |
|  | The ETL Listed Mark provides proof of product compliance with North American safety standards. Authorities Having Jurisdiction (AHJ) and code officials across the US and Canada accept the ETL Listed Mark as proof of product compliance to published industry standards.                                    |
|  | The WEEE symbol indicates that the product should not be discarded as unsorted waste but must be sent to separate collection facilities for recovery and recycling.  |
|  | The CE Marking indicates conformity with health, safety, and environmental protection standards for products sold within the European economic area (EEA).   |

## 1.3 U.S. export compliance

The policy of Endress+Hauser is strict compliance with U.S. export control laws as detailed in the website of the [Bureau of Industry and Security](#) at the U.S. Department of Commerce.

## 1.4 Document function

The document is part of the Operating Instructions and serves as a reference for parameters, providing a detailed explanation of each individual parameter of the operating menu.

### 1.4.1 Target group

The document is aimed at specialists who work with the device over the entire life cycle and perform specific configurations. It is used to perform tasks that require detailed knowledge of the function of the device:

- Commissioning measurements under difficult conditions
- Optimal adaptation of the measurement to difficult conditions
- Detailed configuration of the communication interface
- Error diagnostics in difficult cases

## 2 Introduction

This Endress+Hauser analyzer is shipped with Endress+Hauser's NS 5.14 Firmware. This firmware version provides users with the features and functions to work with the tunable diode laser (TDL) analyzer and is intended to accompany additional manuals that deal with hardware installation and function.

This manual was designed to provide the user with an overview of the NS 5.14 firmware functionality. The user information contained in this manual is divided into the following chapters:





- *Operating the analyzer*
- *Serial port communications*
- *Ethernet communications*
- *Troubleshooting*

### 2.1 Who should read this manual


This manual should be read and referenced by anyone operating or having direct contact with the analyzer.

### 2.2 General note icons

Instructional icons are provided in this manual to alert the user of important information and valuable tips. The following symbols and their associated descriptions are used within this manual.

|   |   |
|---|---|
|  | <p><i>General notes and important information concerning the installation and operation of the analyzer.</i></p>  |
|  | <p><i>Failure to follow all directions may result in malfunction of the analyzer.</i></p>   |
|  | <p><b>INVISIBLE LASER RADIATION</b> - <i>Avoid exposure to beam. Class 3b Radiation Product. Refer servicing to the manufacturer-qualified personnel.</i></p> |
|  | <p><i>Contact may cause electric shock or burn. Turn off and lock out system power before servicing.</i></p>  |

### 2.3 Conventions used in this manual

In addition to the symbols and instructional information, this manual is created with "hot links" to enable the user to quickly navigate between different sections within the manual. and to other manuals. These links are identified by a pointing finger cursor  when rolling over the text. Simply click on the link to navigate to the associated reference.

## 2.4 Manufacturer Address

Endress+Hauser  
11027 Arrow Route  
Rancho Cucamonga, CA 91730  
United States  
[www.endress.com](http://www.endress.com)

## 3 Operating the analyzer



The analyzer is designed to be a stationary measuring device. It should be securely mounted during normal operation.



The laser housing labels on the flanges of the sample cell warn about exposure to laser radiation inside. Never open the sample cell unless directed to do so by service and the analyzer power is turned off. Refer to Service →



The optical head has a seal and “**WARNING**” sticker to prevent inadvertent tampering with the device. Do not attempt to compromise the seal of the optical head assembly. Doing so will result in loss of device sensitivity and inaccurate measurement data. Repairs can then only be performed by the factory and are not covered under warranty.

### 3.1 Firmware version

Each Endress+Hauser analyzer operates with a specific version of firmware. The firmware version for each analyzer is listed in the associated system calibration report, and displays upon start up of the analyzer. The operation instructions provided in this chapter are intended for the NS 5.14 firmware version.

### 3.2 Powering up the analyzer

After mounting the analyzer, connecting the power wires, connecting the gas lines, connecting the (optional) output signal wires and checking for leaks, you are ready to power up the analyzer.



Refer to the figures for the analyzer electronic control boards in the Operating Instruction for fuse location. If you need to replace a fuse, use only the same type and rating of fuse as the original as listed in the analyzer fuse specifications table in the Operating Instruction.

### 3.3 To power up the analyzer

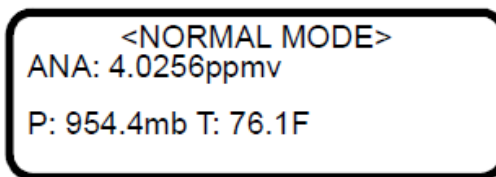
1. Power up the analyzer by energizing the circuit to the analyzer.
2. For systems with a heated enclosure, confirm that the sample system enclosure is heated to approximately the specified temperature by observing the temperature reading on the door mounted thermometer.



For systems with heated enclosures, a **Temperature too Low** or **Temperature too High** fault will activate the **General Fault Alarm** when the enclosure temperature is more than 5 °C above or below the specified temperature. Once the enclosure has reached the specified temperature, reset the **General Fault Alarm** (see *To change parameters in Mode 2* → )

3. The system goes through an initialization period while showing the firmware version on the bottom line until the LCD displays the Normal Mode screen.





The measurements displayed are:

- **ANA:** Refers to the concentration in the sample cell (in units) of the analyte/component selected in **Mode 2**.
  - **P:** Pressure in the sample cell in units selected in **Mode 2**.
  - **T:** Temperature in the sample cell in units selected in **Mode 2**.
4. Enable **Peak Tracking** following the procedure outlined in *To change parameters in Mode 2* →
  5. After initialization and establishment of reference spectra, the LCD displays four lines, the third of which is blank.
  6. Continuous updates of the measurement parameters displaying on the LCD indicates that the analyzer is operating normally.

*Definitions for the acronyms displayed on the LCD are given in the section Modes defined* → .

## 3.4 Powering down the analyzer

It may be necessary to power down the analyzer for problem solving or maintenance reasons. An approved switch or circuit breaker rated for 15 amps should have been installed and clearly marked as the disconnecting device for the analyzer.

### 3.4.1 To power down the analyzer

1. Switch off the power to the analyzer using the switch or circuit breaker designated as the disconnection device for the equipment.
2. If the analyzer is going to be shut down for a short period of time for routine maintenance, isolate the analyzer from the sample conditioning system (SCS) by following the procedure in the operating instructions.
3. If the analyzer is going to be shut down for a long period of time, follow the procedure in the SCS Operating Instruction or contact Endress+Hauser's Service.



Endress+Hauser recommends disconnecting the power completely from the analyzer to prevent potential damage from lightning strikes.

## 3.5 Operating the analyzer from the keypad

The keypad enables the operator to modify measurement units, adjust operational parameters, and perform diagnostics. During normal operation, the LCD continuously displays the measured component's concentration, sample cell temperature, and sample cell pressure.

The Endress+Hauser keypads are shown in the figures below. To activate any functions on the keypad, press the # key followed by a number on the keypad to specify a mode.

CSA-certified products include the SS2100, 2-Pack, 3-Pack, SS500/SS2000/SS300, SS500e/SS2000e/SS3000e, SS500XP/SS2000XP.

ATEX-certified products include the SS2100a, SS2100i-1 and SS2100i-2.



You must press the # key before pressing a number or function key to trigger a response from the keypad.

When you press the # key, the word MODE display on the LCD. If the Keypad Watchdog is enabled, a countdown timer will begin when MODE displays. If the countdown expires and no buttons have been pressed, the analyzer will automatically revert to **Mode 1**.

The \* key functions as the “Enter” key. When in Mode 2, always press \* after entering a value using the keypad (unless the entry was made in error). Pressing the \* key stores the displayed parameter value and cycles the LCD to the next parameter.

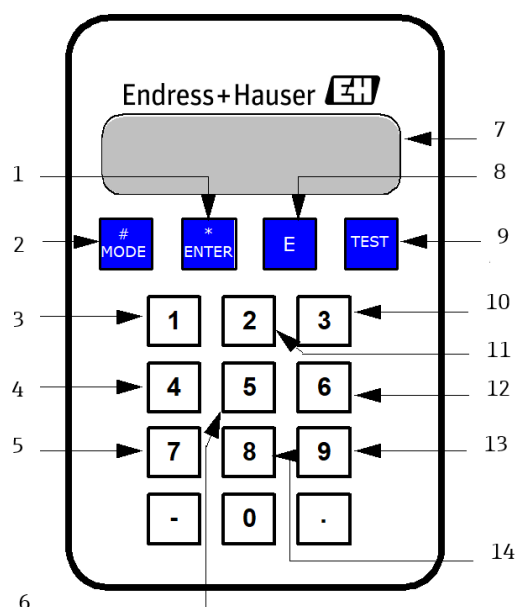


Figure 1. Keypad for CSA-certified analyzers

|    |                                    |
|----|------------------------------------|
| 1  | Enter key                          |
| 2  | Mode menu key                      |
| 3  | Activate process gas               |
| 4  | Diagnostics parameters             |
| 5  | Activate validation 1              |
| 6  | Analog output test                 |
| 7  | LCD (display)                      |
| 8  | Exponent value                     |
| 9  | Scroll direction/analog input test |
| 10 | Scrubber life data                 |
| 11 | Change parameters                  |
| 12 | Export diagnostic data             |

|    |                       |
|----|-----------------------|
| 13 | Validation Results    |
| 14 | Activate Validation 2 |

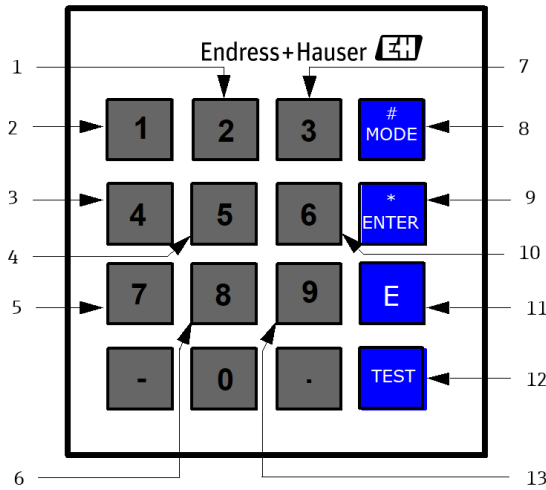


Figure 2. Keypad for ATEX-certified analyzers

|    |                                    |
|----|------------------------------------|
| 1  | Change parameters                  |
| 2  | Activate process gas               |
| 3  | Diagnostics parameters             |
| 4  | Analog output test                 |
| 5  | Activate validation 1              |
| 6  | Activate validation 2              |
| 7  | Scrubber life data                 |
| 8  | Mode menu key                      |
| 9  | Enter key                          |
| 10 | Export diagnostic data             |
| 11 | Exponent value                     |
| 12 | Scroll direction/analog input test |
| 13 | Validation results                 |

If you do make an error, press the \* key followed by the TEST key, and then the \* key to return to the parameter and enter the correct value.

### 3.6 Modes defined

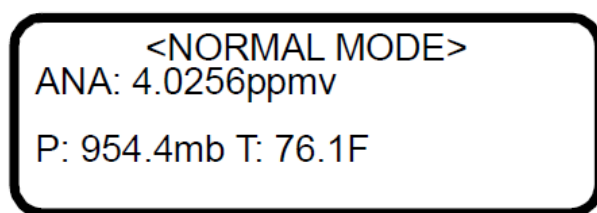
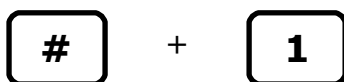
Use the keypad to access the following modes by pressing the # key first followed by a number (1, 2, 4, 5, 6, 7, 8 or 9) to activate a mode. The following section explains each mode and the corresponding information that displays on the LCD.



When the # key is pressed, measurement will be suspended until a new mode is established. The only modes that produce measurements are **Mode 1**, **Mode 6**, **Mode 7** or **Mode 8**.

### 3.6.1 Mode 1: (Normal mode)


**Mode 1** continuously displays updated measurements. Press the # key followed by the 1 key.



The measurements displayed are:

- **ANA**: Refers to the concentration in the sample cell in units of the analyte/component selected in **Mode 2**.
- **P**: Pressure in the sample cell in units selected in **Mode 2**.
- **T**: Temperature in the sample cell in units selected in **Mode 2**.

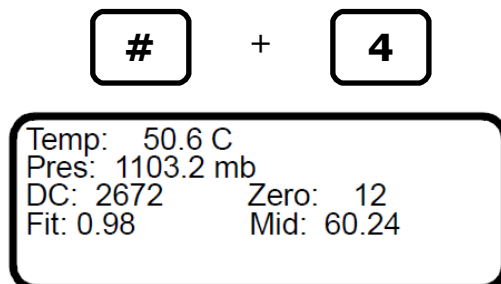
### 3.6.2 Mode 2: (Set parameter mode)

**Mode 2** enables user to view and change measurement parameters. Follow the procedure under *To change parameters in Mode 2* →  for viewing and changing any of the parameters.

### 3.6.3 Mode 3: not used

### 3.6.4 Mode 4: (System Diagnostic parameters)

**Mode 4** displays system diagnostic data. These values may be useful when troubleshooting the system. Press the **#** key followed by the **4** key.



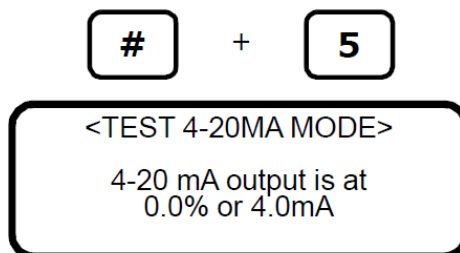
While in this mode the analyzer suspends measurement until you return to **Mode 1**, **Mode 6**, **Mode 7** or **Mode 8**.

The diagnostic parameters displayed are:

- **Temp:** Shows the temperature in the measurement cell when normal sample gas is flowing through it.
- **Pres:** Shows the pressure in the measurement cell when normal sample gas is flowing through it.
- **DC:** Shows the magnitude of the DC laser power in the measurement cell when normal sample gas is flowing through it. Acceptable values are between 800 and 3300. A number below or above this range will trigger a **Laser Power too Low** or **Laser Power too High**, respectively (see *Alarms* → ⓘ) indicating that either the optics need to be cleaned or there is an alignment problem.
- **Zero:** Shows the detector signal value when the laser is turned off. It should be in the range of -50 to +50. Outside of this range, a **Laser Zero Low Alarm** or **Laser Zero High Alarm** (see *Alarms* → ⓘ) occurs.
- **Fit:** The measure of “goodness of fit” for the last measurement point.
- **Mid:** The laser current set point after adjustment by the peak-tracking software.

### 3.6.5 Mode 5: (4-20 mA Test Mode)

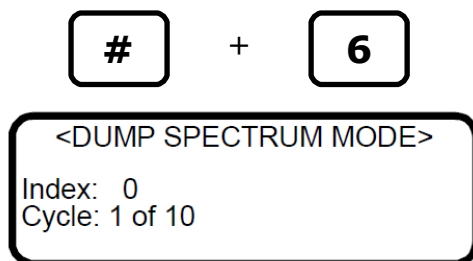
**Mode 5** is used to turn on the 4-20 mA current loop (at the current set with the **4-20 mA Test** parameter) for test and calibration purposes. Press the **#** key followed by the **5** key.



Returning to Mode 1 re-establishes normal 4-20 mA current loop operation.

### 3.6.6 Mode 6: (Diagnostic data download)

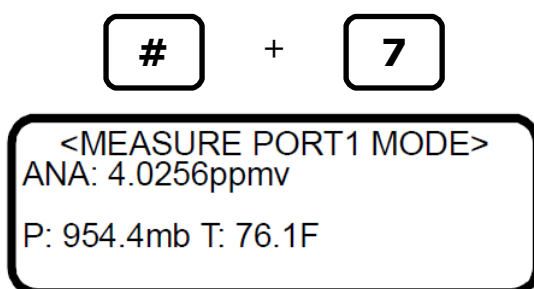
Mode 6 is used to transfer diagnostic data to the serial port and read the individual data points of both the **DC** and **2f** spectra that the instrument analyzes to calculate the gas concentration. Viewing these data can be helpful in diagnosing problems with the analyzer. Press the **#** key followed by the **6** key.



The data points, along with intermediate calculation results, are output to the serial port whenever **Mode 6** is selected.

### 3.6.7 Mode 7: (Measure port1 mode)

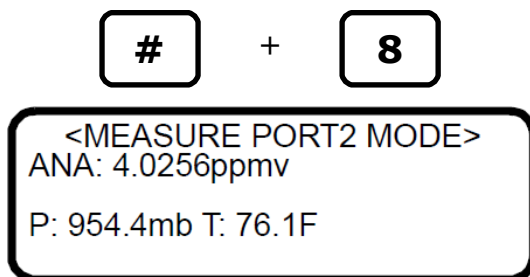
**Mode 7** switches the analyzer to measure validation gas supply #1. Press the # key followed by the 7 key.



Returning to **Mode 1** re-establishes normal operation measuring process gas.

### 3.6.8 Mode 8: (Measure Port2 Mode)

**Mode 8** switches the analyzer to measure validation gas supply #2. Press the # key followed by the 8 key.



Returning to **Mode 1** re-establishes normal operation measuring process gas.

### 3.6.9 Mode 9: (Recall Validation Results)

**Mode 9** recalls the measured value from the last autovalidation cycle on units with autovalidation capability. Press the # key followed by the 9 key.



For systems not set up for a validation, the following screen displays:

```

<VALIDATION RESULTS>
No Validations
Are Defined

```

For systems set up for a single validation, the following screens may be displayed:

1. If an automatic validation or **Mode 7** has not yet been processed:

```

<VALIDATION RESULTS>
Date: 17-04-10 13:00
1:      NO DATA

```

2. If an automatic validation or **Mode 7** has been processed:

```

<VALIDATION RESULTS>
Date: 17-04-10 13:00
1:P 1000.00ppmv
Rng:1000.0 to 1000.0

```

- **Date** is the time of the last validation.
- **1:** is for Validation 1.
- **P** or **F** equals 'Pass' or 'Fail' for the validation result.
- **1000.00ppmv** is the concentration of the last validation result in the user's selected engineering units. If the value is from a **Mode 7** validation, then it is the average validation value for the time period during which the **Mode 7** was run.
- **Rng:1000.0 to 1000.0** is the minimum and maximum concentration value, in the user's selected engineering units, during the last validation time period.

For systems set up for dual validation, the following screens may be displayed:

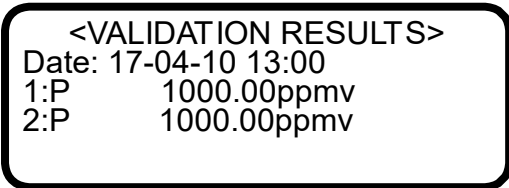
1. If an automatic validation or **Mode 7** or **Mode 8** has not yet been processed:

```

<VALIDATION RESULTS>
Date: 17-04-10 13:00
1:      NO DATA
2:      NO DATA

```

2. If an automatic validation, **Mode 7** or **Mode 8** has been processed:

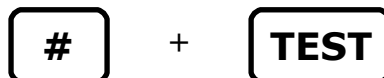


<VALIDATION RESULTS>  
Date: 17-04-10 13:00  
1:P 1000.00ppmv  
2:P 1000.00ppmv

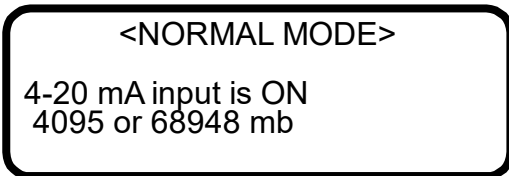
- **Date** is the time of the last validation.
- **1:** or **2:** is for Validation 1 or Validation 2.
- **P** or **F** equals 'Pass' or 'Fail' for the validation result.
- **1000.00ppmv** is the concentration of the last validation result in the user's selected engineering units. If the value is from a **Mode 7** or **Mode 8** validation, then it is the average validation value for the time period during which the **Mode 7** or **Mode 8** was run.

### 3.6.10 Mode Test: (Analog Input Test Mode)

Mode Test is used to view a real-time reading of the 4-20 mA analog input state, as well as its current raw and scaled values for test and calibration purposes. In this mode, the analyzer functions normally, as in Mode 1, except that the LCD (display) shows the 4-20 mA analog input signal instead of the current concentration, temperature and pressure. Press the # key followed by the TEST key.



# + TEST



<NORMAL MODE>  
4-20 mA input is ON  
4095 or 68948 mb



## 4 Configuring the analyzer at start-up

Endress+Hauser analyzers are pre-programmed at the factory with most parameters set to default values, which are suitable for most applications. There are a few parameters that should be set by the end user. Endress+Hauser recommends checking all the parameters at start-up.

### 4.1 Parameter setting/checking procedure:

1. After the analyzer has been installed and start up has been completed, press **Mode 2 (#2)** from the analyzer keypad and enter password **3142**.
2. Press the **\*** key repeatedly to scroll through the parameters and verify the settings.



*The firmware default parameter settings are reflected in the table below.*

3. Peak Tracking set = 1 (On).



*Peak Tracking may be turned off at the factory prior to shipment to prevent the peak tracking algorithm from shifting the spectrum during initial warm-up of the unit. Once the unit is installed in the field and the cell temperature has stabilized (typically after 5 hours minimum), the Peak Tracking should be turned on and left on at all times.*

4. Set remaining parameters as desired for the specific analyzer application. Refer to the table below.
5. After the analyzer is configured, allow the system to run for 24 hours and then clear all alarms.
  - a. Press **Mode 2 (#2)** from the analyzer keypad and enter password **3142**.
  - b. Set the **General Alarm DO** parameter to **2**.
  - c. Set the **Cancel Val Alarms** parameter to **1**.

### 4.2 Changing measurement and control parameters

In **Mode 2**, all of the pertinent measurement and control parameters can be viewed and changed. Refer to the Table for a list of parameters and value range. The parameters are listed in the order viewed during **Mode 2** operation.

| Parameter          | Setting                          | Function   |
|--------------------|----------------------------------|--|
| Logger rate        | 1 – 1000 readings<br>Default = 8 | Sets the number of measurements included in the running average.                                 |
| Temperature unit   | 0 or 1<br>Default = 0            | Sets the display unit for temperature.   |
| Pressure unit      | 0, 1, 2, or 3<br>Default = 0     | Sets the display unit for pressure.  |
| Concentration unit | 0 to 8<br>Default = 0            | Sets the display unit for concentration.   |
| Custom precision   | 0 or 5<br>Default = 2            | The number of digits to display to the right of the decimal on the LCD and <b>Mode 1</b> output. |

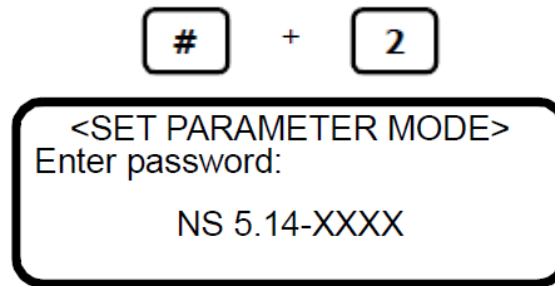
|  |                                       |   |
|--|---------------------------------------|---|
| RATA<br>(Relative accuracy test audit) | 0 or 1<br>Default: 0                  | Enables or disables adjustment factors.   |
| RATA multiplier                        | -1.E+06 to 1.E+06<br>Default 1.0      | Slope adjustment factor.  |
| RATA offset                            | -1.E+06 to 1.E+06<br>Default 0.0      | Offset adjustment factor.   |
| Update RATA                            | 0 or 1<br>Default: 0                  | Updates RATA Multiplier and Offset to automatically calculated values.                      |
| Peak tracking                          | 0, 1 or 2<br>Default: 0               | Sets peak tracking capability to off, on or reset.  |
| Keypad watchdog                        | < 5:Off, >=5:Secs<br>Default = 10     | The time-out on the Mode screen before the analyzer automatically reverts to Normal Mode.   |
| Set time - hour                        | 0 to 23<br>Default: 0                 | Sets the current hour.  |
| Set time - minute                      | 0 to 59<br>Default: 0                 | Sets the current minute.  |
| Set time - day                         | 1 to 31<br>Default: 1                 | Sets the present day.   |
| Set time - month                       | 1 to 12<br>Default: 1                 | Sets the present month.   |
| Set Time - year                        | 2006 to 2144<br>Default: 2017         | Sets the present year.  |
| General alarm DO                       | 0, 1, or 2<br>Default = 0             | Sets the alarm mode (latching or non-latching) and resets the general alarm once activated. |
| DO alarm setup                         | 4.29E+09<br>Default = 8192            | Sets the functionality of the secondary digital output.                                     |
| Low alarm setpoint                     | -1.E+06 to 1.E+06<br>Default = -10000 | Sets the low alarm threshold for moving average.  |
| High alarm setpoint                    | -1.E+06 to 1.E+06<br>Default = 10000  | Sets the high alarm threshold for moving average.   |
| AO 4-20 mA test                        | 0.0 to 100.0<br>Default: 0.0          | Sets the 4-20 mA output to a percentage of full scale.                                      |

|                      |                                    |   |
|----------------------|------------------------------------|---|
| 4-20 mA alarm action | 0, 1, 2 or 3<br>Default: 0         | Sets the current loop state upon alarm condition.   |
| AO 4 mA value        | -1.E+06 to 1.E+06<br>Default 0.0   | Sets ppmv value corresponding to 4 mA current loop output.  |
| AO 20 mA value       | -1.E+06 to 1.E+06<br>Default 100.0 | Sets ppmv value corresponding to 20 mA current loop output.   |
| Calculate dew point  | 0, 1 or 2<br>Default = 0           | 0=Disable, 1=Enable on LCD & AO, 2=Enable on LCD, but not AO for dew point temperature calculation and display. |
| Dew point method     | 0, 1, 2 or 3<br>Default = 0        | Sets method used to calculate dew point temperature.  |
| Pipeline pressure    | 0.0 to 500000<br>Default = 1000    | Sets pressure at which dew point temperature is calculated.   |
| AI pressure input    | 0 or 1<br>Default = 0              | Enables or disables usage of pipeline pressure via analog input.  |
| AI 4 mA value        | 0-500000<br>Default = 0.0          | Sets value corresponding to 4 mA current loop input (mb).   |
| AI 20 mA value       | 0-500000<br>Default = 100000       | Sets value corresponding to 20 mA current loop input (mb).  |
| Modbus address       | User Set, 0-250<br>Default: 0      | Sets the address for the analyzer.  |
| Modbus mode          | User Set, 0, 1, or 2<br>Default: 0 | Sets type of Modbus protocol.   |
| 2-Way com port       | 0, 1, 2 or 3<br>Default = 1        | Sets the communications port for the port for which two-way communications is allowed.                          |
| Baud rate            | 0, 1, 2, 3 or 4<br>Default: 3      | Sets RS-232 port baud rate.   |
| Validation wait time | 60-32000<br>Default = 60           | The amount of time (in seconds) for validation gas to purge the system.   |
| Val attempts         | 1 to 8000<br>Default = 1           | Sets the number of attempt(s) to run during the perm tube Validation Mode.                                      |
| Val 1 concentration  | 0 to Full Scale<br>Default: 100    | Sets concentration of validation gas supply #1.   |

|  |                                |   |
|--|--------------------------------|---|
| Val 2 concentration                          | 0 to Full Scale<br>Default: 60 | Sets concentration of validation gas supply #2.                                 |
| Validation allowance                         | 0.0 to 100.0<br>Default: 10    | Sets acceptable deviation (in %) for validation.                                |
| Zero val tolerance                           | 0.0 to 1000000<br>Default = 0  | Sets maximum acceptable zero measurement reading during validation routine.     |
| Daily validation                             | 0 or 1<br>Default: 0           | Turns daily autovalidation on or off.   |
| Val interval                                 | 1 to 400<br>Default: 1         | Interval (in days) between validation cycles.                                   |
| Val start time                               | 0 to 23<br>Default: 9          | Sets the hour of the day for validation.  |
| Start validation                             | 0 or 1<br>Default: 0           | Initiates validation cycle.   |
| 4-20 mA val action                           | 0 or 1<br>Default: 0           | Sets the current loop mode during validation.                                   |
| ValPerm constant Kp                          | 0 to 1000000<br>Default = 0    | The system constant for the perm tube.  |
| ValPerm rate Rp                              | 0 to 1000000<br>Default = 0    | The calibrated permeation rate for the perm tube.                               |
| Cancel val alarms                            | 0 or 1<br>Default: 0           | Resets the validation alarms and relays.  |
| Val auto DumpSpectrm                         | 0 or 1<br>Default: 0           | Sets the analyzer to dump spectrum information during a validation measurement. |
| Operator password                            | 0 to 9999<br>Default: 0        | Password for Operator Parameter section.  |
| Operator Parameter01 to Operator Parameter20 | Parameter Index<br>Default: 0  | Parameter setup for Operator Parameter section.                                 |

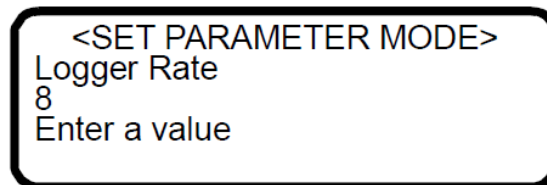
### 4.2.1 To change parameters in Mode 2

1. Press the # key followed by the 2 key.



The LCD prompts for a numeric password.

2. To enter the customer parameters section for complete access to all customer parameters, enter the user password (**3142**) on the keypad.  
To enter the operator parameter section for access to the user definable set of customer parameters, enter the operator password as defined in the operator password parameter.  
Then press the \* key to enter the number.



3. Starting with the first parameter that displays, enter a new value and/or press the \* key to store the value and cycle to the next parameter.
4. When finished changing or viewing the measurement and control parameters, press the # key followed by the 1 key to return to **Mode 1** and normal operation.

*The scroll direction can be reversed by pressing the **TEST** key followed by the \* key.*

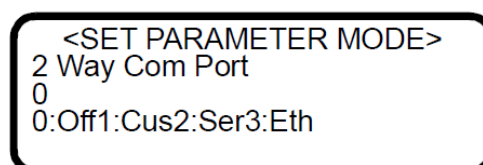
## 4.3 Measurement and control parameters defined

The definitions for the measurement and control parameters are shown below in alphabetical order for easy reference. Refer to the Table below to review order listed during **Mode 2** configuration.

### 4.4 2 way com port

The **2 Way Com Port** parameter sets the port that allows two-way communications, including Modbus and the diagnostic protocol. Enter **0** to turn off two-way communications, **1** for the customer port, **2** for the service port and **3** for the Ethernet port, if applicable.

The customer port baud rate is set from the **Baud Rate** parameter with 8 data bits, 1 stop bit and no parity. The service port baud rate is 115200 with 8 data bits, 1 stop bit and no parity. If the Ethernet port is available, refer to *Configuring the built-in Ethernet port* →



## 4.5 4-20 mA alarm action

The **4-20 mA Alarm Action** determines the current loop state upon an alarm condition. Enter **0** for no action, **1** for the current loop to assume a low state upon an alarm condition, **2** for the current loop to assume a high state upon an alarm condition, or **3** for the current loop to track and hold the current state upon an alarm condition.

```
<CH A SET PARAMETER>
4-20 mA Alarm Action
0
0:L 1:H 2:T&H 3:None
```

## 4.6 4-20 mA val action

The **4-20 mA Val Action** parameter sets the operation mode of the **4-20 mA** current loop during validation cycles. Enter **0** for the current loop to track and hold the last process measurement or **1** for the current loop to continue to output the analyzer measurements during the validation cycle.

```
<SET PARAMETER MODE>
4-20 mA Val Action
0
0:Hold 1:Measure
```

## 4.7 AI 4 mA value

The **AI 4 mA Value** parameter sets the pressure (in millibar) corresponding to a 4 mA analog input. Enter the required value.

```
<SET PARAMETER MODE>
AI 4 mA Value
0.00000
Enter a value (mb)
```

## 4.8 AI 20 mA value

The **AI 20 mA Value** parameter sets the pressure (in millibar) corresponding to a 20 mA analog input. Enter the required value.

```
<SET PARAMETER MODE>
AI 20 mA Value
0.00000
Enter a value (mb)
```

## 4.9 AI pressure input

The **AI Pressure Input** parameter enables or disables usage of a live pipeline pressure via the analog input for the calculation and display of dew point temperature. There are two choices: **0** to turn the analog pressure input off, and **1** to turn it on. If this parameter is disabled, then a fixed pipeline pressure must be entered through the **Pipeline Pressure** parameter.

```

<SET PARAMETER MODE>
AI Pressure Input
0
0:Disable 1:Enable

```

#### 4.10 AO 4 mA value

The **AO 4 mA Value** parameter sets the concentration (in ppmv) or dew point temperature (in degrees Celsius or Fahrenheit), depending on whether dew point temperature calculation and display are enabled (i.e., the **Calculate Dew Point** parameter set equal to 1), corresponding to a 4 mA current loop output.

```

<SET PARAMETER MODE>
AO 4 mA Value
0.00000
ppmv or DewPoint F/C

```

#### 4.11 AO 4-20 mA test

The **AO 4-20 mA Test** parameter sets the output of the current loop when in **Mode 5** for testing and calibration purposes. The value entered represents a percent of scale value where zero equals 4 mA and full scale equals 20 mA. Thus, the current loop output,  $I$ , is given by

$$I = R(20mA - 4mA) + 4mA$$

where  $R$  is the **4-20 mA % Test** parameter value.

```

<SET PARAMETER MODE>
AO 4-20 mA Test
0.00000
Enter a value (%)

```

#### 4.12 AO 20 mA Value

The **AO 20 mA Value** parameter sets the concentration (in ppmv) or dew point temperature (in degrees Celsius or Fahrenheit), depending on whether dew point temperature calculation and display are enabled (i.e., the **Calculate Dew Point** parameter set equal to 1), corresponding to a 20 mA current loop output.

```

<SET PARAMETER MODE>
AO 20 mA Value
0.00000
ppmv or DewPoint F/C

```

### 4.13 Baud rate

The **Baud Rate** parameter sets the baud rate for the customer RS-232 port. Enter **0** for 19200, **1** for 38400, **2** for 57600, **3** for 115200 or **4** for 9600 baud. The other settings for this port are 8 data bits, 1 stop bit, no parity and no hardware flow control.

```
<SET PARAMETER MODE>
Baud Rate
3
0:19 1:38 2:57 3:115
```



*Make sure that the COM port used is set for the same baud rate as the analyzer.*

### 4.14 Calculate dew point

The **Calculate Dew Point** parameter enables or disables the calculation and display of dew point temperature. There are three choices: **0** to turn the calculation and display of dew point temperature off, **1** to allow the dew point to be output on the LCD and on the analog output (setup of the AO 4 mA and 20 mA values is required), and **2** to allow the dew point to be output on the LCD only.

```
<SET PARAMETER MODE>
Calculate Dew Point
0
0:Off 1:LCD&AO 2:LCD
```

### 4.15 Cancel val alarms

The **Cancel Val Alarms** parameter cancels the validation alarm and resets all validation flags once activated. Entering **1** cancels the alarm. Once the action is complete the parameter automatically reverts to **0**.

```
<SET PARAMETER MODE>
Cancel Val Alarms
0.00000
1:Cancel
```

### 4.16 Concentration unit

The **Concentration Unit** parameter designates the display units for the measured concentration. The following options include:

- **0** for ppmv
- **1** for lbs/MMscf [displays as lb/MMcf; MMscf = million standard cubic feet]
- **2** for %
- **3** for mg/nm<sup>3</sup> [nm<sup>3</sup> = normal cubic meters]
- **4** for ppmw



- 5 for ppbv
- 6 for ppbw
- 7 for grains/100scf [displays as grn/ccf; 100 scf = ccf = 100 standard cubic feet]
- 8 for custom display units and conversion factor (user EU Tag Part 1 and 2 as defined by Modbus registers 45203 and 45205)



*Based on ISO 13443:1996 Natural Gas, ISO, 5024, ASTM D1071- Standard reference conditions are 15 °C, 101.325 kPa and Normal reference conditions are 0 °C, 101.325 kPa. Default conversion factors are based on pipeline quality natural gas.*

If the display units are correct but the conversion factor is not correct for the application, a custom conversion factor can be defined using Modbus. To set a custom conversion fact, first choose the correct display units (based on the **Concentration Unit** parameter), and then define the conversion factor for the associated display units using Modbus. If the Modbus register is set to **0**, then the default conversion factor is used. However, if it is set to a value greater than 0, then that value is used as the conversion factor. Refer to the following Modbus parameters for more information:

- ppmv ConvFactor 00
- lb ConvFactor 01
- % ConvFactor 02
- mg ConvFactor 03
- ppmw ConvFactor 04
- ppbv ConvFactor 05
- ppbw ConvFactor 06
- grn ConvFactor 07
- user ConvFactor 08

The default conversion factors are defined in Table below. These conversions are only intended as a starting point and are specific to our most common applications. Furthermore, weight-based units are dependent on the molecular weight of the background stream, and therefore the conversion factor must be determined on a case-by-case basis.

*Default conversion factors per analyte*

| Ppmv | Ib/MMcf   | %      | mg/Nm3 | ppmw | ppbv    | ppbw    | grn/ccf   |
|------|-----------|--------|--------|------|---------|---------|-----------|
| 0    | 1         | 3      | 4      | 5    | 6       | 7       | 8         |
| 1.00 | 0.0473933 | 0.0001 | 1.46   | 1.40 | 1000.00 | 1400.00 | 0.0626285 |

If a correct concentration unit option for the display units does not exist, then a custom display unit and conversion can be created using Modbus. To set a custom display unit, select option 8 for the **Concentration Unit** parameter. Next define the ASCII display text and associated conversion factor using Modbus.

```
<SET PARAMETER MODE>
Concentration Unit
0
0:ppm 1:lbs 2:% 3:mg
```

*The LCD content can vary slightly depending on system configuration.*

## 4.17 Custom precision

The **Custom Precision** parameter sets the number of viewable digits to the right of the decimal point. The total number of digits the analyzer can display at any one time is six. Therefore, when the size of the value plus the Custom Precision exceeds six, the number of digits to the right of the decimal point will be reduced accordingly.

```
<SET PARAMETER MODE>
Custom Precision
2
Enter a value
```

## 4.18 Daily validation

The **Daily Validation** parameter enables or disables the time of day autovalidation feature. When enabled, an autovalidation cycle is initiated every 'X' day (where 'X' is defined by **Val Interval**) at the time of day established by **Val Start Time**. Enter **0** to turn the feature off or **1** to turn the feature on.

```
<SET PARAMETER MODE>
Daily Validation
0
0:Disable 1:Enable
```

### 4.19 Dew point method

The **Dew Point Method** parameter sets the type of industry standard dew point calculation to be performed when **Calculate Dew Point** is enabled. Enter **0** for ISO 18453:2006, **1** for ASTM 1142-95 Eq. (1), **2** for ASTM 1142-95 Eq. (2), and **3** for the Arden Buck method.

```
<SET PARAMETER MODE>
Dew Point Method
0
0:ISO1:AS12:AS23:AB
```



*The ISO method is only valid for sample pressures greater than 10000 mbar (10 bar), and therefore should not be used for samples with pipeline pressures less than 10000 mbar. The analyzer firmware assumes that any pipeline pressure less than 10 bar is the same as 10 bar, so the measured Dew Point value will not change for sample pressures from 0 to 10 bar. For Natural Gas sample pressures in the 0 to 10000 mbar range, Endress+Hauser recommends users select ASTM1 or ASTM2 methods. For air or nitrogen samples, Endress+Hauser recommends the Arden Buck method (Dew Point Method = 3).*

### 4.20 DO alarm setup

The **DO Alarm Setup** parameter sets the functionality of the **Assignable Alarm**. Add the hexadecimal values according to the table below for each fault chosen to trigger the **Assignable Alarm**. Convert the resulting hexadecimal value to a decimal value and enter the number for normally deactivated relay functionality. Add '1' to the resulting decimal value to switch to normally activated functionality.

```
<SET PARAMETER MODE>
DO Alarm Setup
8192
Enter decimal value
```

In the example above, the hexadecimal value of 0002000 converts to decimal value of 8192, which when entered results in a normally deactivated relay triggered by the **Concentra High Alarm**. Entering a value of 8193 would result in a normally activated relay (fail safe) triggered by the **Concentra High Alarm**.

| Bit | Hex Value | Alarm Functionality                       |
|-----|-----------|---|
| 0   | 0000001   | Normally closed or power fail (always on) |
| 1   | 0000002   | Any alarm active (general fault)          |
| 2   | 0000004   | Laser power is too low                    |
| 3   | 0000008   | Laser power is too high                   |
| 4   | 0000010   | Laser zero is too low                     |
| 5   | 0000020   | Laser zero is too high                    |

|    |          |   |
|----|----------|---|
| 6  | 0000040  | Laser current is too low                |
| 7  | 0000080  | Laser current is too high               |
| 8  | 0000100  | Pressure is too low                     |
| 9  | 0000200  | Pressure is too high                    |
| 10 | 0000400  | Temperature is too low                  |
| 11 | 0000800  | Temperature is too high                 |
| 12 | 0010000  | Concentration is too low                |
| 13 | 0002000  | Concentration is too high               |
| 14 | 0004000  | Peak tracking restart exceeds limit     |
| 15 | 0008000  | Fitting restart exceeds limit           |
| 16 | 0010000  | Ramp adjust restart exceeds limit       |
| 17 | 0020000  | Not used                                |
| 18 | 0040000  | Not used                                |
| 19 | 0080000  | Flow switch alarm                       |
| 20 | 0100000  | Validation fail alarm 1                 |
| 21 | 0200000  | Validation fail alarm 2                 |
| 22 | 0400000  | Not used                                |
| 23 | 0800000  | Not used                                |
| 24 | 1000000  | Delta DC restart exceeds limit          |
| 25 | 2000000  | Delta temperature restart exceeds limit |
| 26 | 4000000  | Dry pressure restart exceeds limit      |
| 27 | 8000000  | Need to change scrubber                 |
| 28 | 10000000 | R2 restart exceeds limit                |
| 29 | 20000000 | R3 restart exceeds limit                |

|    |          |                                      |
|----|----------|--------------------------------------|
| 30 | 40000000 | Pressure delta restart exceeds limit |
| 31 | 80000000 | Low purge rate alarm                 |

## 4.21 General alarm DO

The **General Alarm DO** sets the operation of the general alarm relay digital output when a general fault alarm occurs. The relay is normally energized making it fail-safe for detection of not only alarms, but also power failures. Enter **0** to make the relay latching, which means any general fault alarm will de-energize the relay and keep it de-energized even if the alarm condition clears. This parameter must be reset to return the relay to 'normal' state. Enter a **1** to make the relay non-latching, which means any general fault alarm will de-energize the relay; however, when the alarm condition clears, the relay will automatically reset to its normal state. Enter a **2** to reset the relay and any active alarms to the 'normal' state. After the relay resets, this parameter will automatically revert to the setting from before the reset was initiated.

```
<SET PARAMETER MODE>
General Alarm DO
0
0:L 1:NonL 2:Reset
```

## 4.22 High alarm setpoint

The **High Alarm Setpoint** parameter determines the concentration threshold above which the **Concentra High Alarm** fault will be triggered (see *Alarms* → ☰). The value entered is compared to the moving average over the number of measurement points set by the **Logger Rate**. The setpoint must have a value greater than the maximum range of the analyzer or maximum dew point to be turned off.

```
<SET PARAMETER MODE>
High Alarm Setpoint
0.00000
ppmv or DewPoint F/C
```

## 4.23 Keypad watchdog

The **Keypad Watchdog** parameter sets the allowable time (in seconds) that the analyzer can be on the MODE screen and the **Mode 2** (Set Parameter Mode) password screen before automatically reverting to **Mode 1** (Normal Mode). Setting this parameter to a value less than five (5) will disable this feature. If it is set for greater than or equal to five (5), then the value represents the number of seconds before the analyzer reverts to Normal Mode.

```
<SET PARAMETER MODE>
Keypad Watchdog
0
<5:Off >=5:Secs
```

## 4.24 Logger rate

The **Logger Rate** parameter sets the number of measurements included in the running average. The display and the current loop output will each have a value representing the running average of the concentration over a number of measurements equal to **Logger Rate**. Enter the required value.

```

<SET PARAMETER MODE>
Logger Rate
8
Enter a value

```

## 4.25 Low alarm setpoint

The **Low Alarm Setpoint** parameter determines the concentration threshold below which the **Concentra Low Alarm** fault will be triggered (see *Alarms* → ☰). The value entered is compared to the moving average over the number of measurement points set by the **Logger Rate**. The setpoint must have a value less than the minimum range of the analyzer or minimum dew point to be turned off.

```

<SET PARAMETER MODE>
Low Alarm Setpoint
0.00000
ppmv or DewPoint F/C

```

## 4.26 Modbus address

The **Modbus Address** parameter sets the analyzer address for when the analyzer is used as a Modbus slave device. Addresses from 1 to 250 can be entered.

```

<SET PARAMETER MODE>
Modbus Address
1
Enter node (1-250)

```

## 4.27 Modbus mode

The **Modbus Mode** parameter sets the communications protocol for the port selected in the **2 Way Com Port** parameter. There are three choices: **0** for turning the Modbus capabilities off and defaulting to generic serial output as described in *Receiving Serial Data (Customer Port Output)* → ☰ (the ports not designated for two-way communications will also output the generic serial output); **1** for enabling the analyzer to respond to Gould Modbus RTU function codes 3, 6 and 16; and **2** for enabling the analyzer to respond to Daniel Modbus RTU function codes 3, 6 and 16.

```

<SET PARAMETER MODE>
Modbus Mode
0
0:Off 1:GMR 2:DMR

```

## 4.28 Operator Parameter01 to operator Parameter20

These parameters enable the setup of the Operator Parameter section. A parameter index may be entered for each parameter to be displayed when the analyzer is in the Operator Parameter section. Refer to the Table. Entering a **0** (zero) will prevent a parameter from being displayed.

## 4.29 To access the Operator Parameter section

1. From the analyzer keypad, press the **#** key followed by the **2** key to enter **Mode 2**.

2. Enter the Operator Password as defined in the Operator Password parameter and press the \* key.



Refer to the section called Operator Password →  for more information.

Only those parameters with a parameter index indicated will be displayed. If none of the 20 parameters have an index defined, the following screen will display while in Operator Parameter section.

<SET PARAMETER MODE>  
No Operator  
parameters defined.  
Press MODE to exit.

<SET PARAMETER MODE>  
Operator Parameter01  
0  
Enter a parameter #

| Parameter            | Index | Parameter           | Index |
|----------------------|-------|---------------------|-------|
| Validation wait time | 24    | Modbus mode         | 108   |
| High alarm setpoint  | 27    | Low alarm setpoint  | 121   |
| Logger rate          | 28    | AO 20 mA test       | 128   |
| Temperature unit     | 29    | 4-20 mA val action  | 128   |
| Pressure unit        | 30    | Calculate dew point | 131   |
| Concentration unit   | 31    | Pipeline pressure   | 216   |
| Val 1 concentration  | 33    | Dew point method    | 133   |
| Validation allowance | 34    | AO 4 mA value       | 134   |
| Cancel val alarms    | 35    | AO 20 mA value      | 135   |
| Set time – tear      | 36    | AI pressure input   | 148   |
| Set time – month     | 37    | AI mA value         | 149   |
| Set time – day       | 38    | AI 20 mA value      | 150   |
| Set time – hour      | 39    | Zero val tolerance  | 159   |

|                      |     |                     |     |
|----------------------|-----|---------------------|-----|
| Set time - minute    | 40  | DO alarm setup      | 168 |
| Val start time       | 41  | Val interval        | 169 |
| 4-20 mA alarm action | 64  | Val attempts        | 178 |
| General alarm DO     | 65  | 2-Way com port      | 184 |
| Baud rate            | 66  | ValPerm constant Kp | 186 |
| Start validation     | 71  | ValPerm rate Rp     | 187 |
| Daily validation     | 72  | Keypad watchdog     | 189 |
| RATA                 | 75  | Custom precision    | 204 |
| RATA multiplier      | 76  | Peak tracking       | 219 |
| RATA offset          | 77  | Val 2 concentration | 223 |
| Val auto DumpSpectrm | 100 | Update RATA         | 225 |
| Modbus address       | 107 | Operator password   | 226 |

### 4.30 Operator password

The **Operator Password** parameter enables or disables a password requirement for entering the Operator Parameter section. Enter **0** for a password to disable a password requirement, or a positive value (up to four digits) to require a password. If **0** is used, accessing the Operator Parameter section requires only pressing the **#** key followed by the **2** key (to enter **Mode 2**), and then pressing the **\*** key (without entering a password) to display the first parameter.

```

<SET PARAMETER MODE>
Operator Password
0
0:No p/w >0:p/w

```

### 4.31 Peak tracking

The **Peak Tracking** function is a software utility that periodically adjusts the laser current to keep the absorption peak of the measured component at a known location. There are three choices: **0** for no peak tracking, **1** for peak tracking (default), and **2** to reset the peak to its factory default setting. Selecting **2** will return the current analyzer

```

<SET PARAMETER MODE>
Peak Tracking
1
0:Off 1:On 2:Rst

```



midpoint to the factory default midpoint, and then automatically revert the parameter value to its setting before the reset was initiated. In most cases, the peak tracking should be set to **1** for on.

### 4.32 Pipeline pressure

The **Pipeline Pressure** parameter sets the pipeline pressure (in mbar) in the current dew point calculation or, if enabled, displays the current pipeline pressure input through the AI Pressure Input. Enter the required value.

```
<SET PARAMETER MODE>
Pipeline Pressure
0.00000
Enter a value (mb)
```

### 4.33 Pressure unit

The **Pressure Unit** parameter designates the display units for the measured absolute pressure in the cell. There are four choices: **0** for millibar, **1** for Torr, **2** for kPa, and **3** for PSIA.

```
<SET PARAMETER MODE>
Pressure Unit
0
0:mb1:Torr2:kPa3:psi
```

### 4.34 RATA (Relative Accuracy Test Audit)

The **RATA** parameter enables or disables user definable values that enable adjustment (without affecting the factory calibration) of the analyzer reading in the field [see *Adjusting Analyzer Reading to Match Specific Standard(s)* → ]. Enter **0** to disable and **1** to enable RATA.

```
<SET PARAMETER MODE>
RATA
0
0:Disable 1:Enable
```

### 4.35 RATA Multiplier

The **RATA Multiplier** parameter is a user definable value that enables adjustment (without affecting the factory calibration) of the analyzer response (or slope) in the field [see *Adjusting Analyzer Reading to Match Specific Standard(s)* → ]. Enter the required value.

```
<SET PARAMETER MODE>
RATA Multiplier
1.00000
Enter a value
```

### 4.36 RATA offset

The **RATA Offset** parameter is a user definable value that enables adjustment (without affecting the factory calibration) of the analyzer offset in the field, see *Adjusting Analyzer Reading to Match Specific Standard(s)* → . Enter the required value.

```
<SET PARAMETER MODE>
RATA Offset
0.00000
Enter a value
```

### 4.37 Set time - day

The **Set Time - Day** parameter sets the current day for the clock driving daily validations. Enter the required value.

```
<SET PARAMETER MODE>
Set Time - Day
07
Enter a value (DD)
```

### 4.38 Set time - hour

The **Set Time - Hour** parameter sets the current hour for the clock driving daily validations. Enter the required value.

```
<SET PARAMETER MODE>
Set Time - Hour
7
Enter a value (0-23)
```

### 4.39 Set time - minute

The **Set Time - Minute** parameter sets the current minute for the clock driving daily validations. Enter the required value.

```
<SET PARAMETER MODE>
Set Time - Minute
5
Enter a value (0-59)
```

### 4.40 Set time - month

The **Set Time - Month** parameter sets the current month for the clock driving daily validations. Enter the required value.

```
<SET PARAMETER MODE>
Set Time - Month
10
Enter a value (MM)
```

### 4.41 Set time - year

The **Set Time - Year** parameter sets the current year for the clock driving daily validations. Enter the required value.

```

<SET PARAMETER MODE>
Set Time - Year
2014
Enter a value (YYYY)

```

#### 4.42 Start validation

The **Start Validation** parameter initiates the validation cycle. After the cycle begins, this parameter automatically reverts to 0.

```

<SET PARAMETER MODE>
Start Validation
1
1:Start

```

#### 4.43 Temperature unit

The **Temperature Unit** parameter designates the display units for the measured cell temperature. There are two choices: **0** for degrees Celsius and **1** for Fahrenheit. The default value is the standard unit of measurement in the region the analyzer is being used.

```

<SET PARAMETER MODE>
Temperature Unit
0
0:C 1:F

```

#### 4.44 Update RATA


The **Update RATA** parameter is used to update the **RATA Multiplier** and **RATA Offset** parameters with the latest automatically calculated values. Each time an automatic, semi-automatic, manual **Mode 7** or manual **Mode 8** validation is completed, a new **RATA Multiplier** and **RATA Offset** will be calculated. This parameter displays the current **RATA Multiplier** and **RATA Offset** in the left column of the display as defined in their respective parameter descriptions. In the right column, the newly calculated values are displayed. To accept and use the newly calculated values, enter **1**. These values will be invoked when pressing the MODE button while exiting **Mode 2**.

```

<SET PARAMETER MODE>
Mult: 1.00 New: 1.00
Ofst: 0.00 New: 0.00
0          1: Update RATA

```



Refer to the section called *Adjusting Analyzer Reading to Match Specific Standard(s)* →  for more information.

## 4.45 Val 1 concentration

The **Val 1 Concentration** parameter sets the concentration value of validation gas supply #1. The analyzer can be configured for a zero gas by setting this parameter to 0.0, and then setting the **Zero Val Tolerance** to the maximum acceptable reading. Otherwise, set this parameter to the concentration value of the validation gas supply and set **Validation Allowance** to the allowable variation range ( $\pm\%$ ).

```
<SET PARAMETER MODE>
Val 1 Concentration
60.0
0:ZeroGas >0:ppmvVal
```



*When procuring a gas standard, make sure the background gas is that specified or a mix that closely resembles the contents of the process stream. Have the gas standard certified to better than the specified precision of the analyzer, if possible.*

## 4.46 Val 2 concentration

The **Val 2 Concentration** parameter sets the concentration value of validation gas supply #2. The analyzer can be configured for a zero gas by setting this parameter to 0.0, and then setting the **Zero Val Tolerance** to the maximum acceptable reading. Otherwise, set this parameter to the concentration value of the validation gas supply and set **Validation Allowance** to the allowable variation range ( $\pm\%$ ).

```
<SET PARAMETER MODE>
Val 2 Concentration
280.000
0:ZeroGas >0:ppmvVal
```





*When procuring a gas standard, make sure the background gas is that specified or a mix that closely resembles the contents of the process stream. Have the gas standard certified to better than the specified precision of the analyzer, if possible.*

## 4.47 Val attempts



*This parameter only applies to permeation type validation.*

The **Val Attempts** parameter sets the maximum number of times the analyzer attempts to measure the validation gas within the set tolerances (see *Zero val tolerance* →  and *Validation allowance* → ) before stopping the autovalidation sequence and triggering a **Validation Fail Alarm**. Enter the required value.

```

<SET PARAMETER MODE>
Val Attempts
2
Enter a value

```

#### 4.48 Val auto DumpSpectrm

The **Val Auto DumpSpectrm** parameter determines whether a **Mode 6** dump automatically occurs after each validation measurement. There are two choices: **0** to turn the automatic data dump during validation off, and **1** to turn it on.

```

<SET PARAMETER MODE>
Val Auto DumpSpectrm
0
0:Disable 1:Enable

```

#### 4.49 Validation allowance

The **Validation Allowance** parameter sets the tolerance ( $\pm\%$ ) for validation measurement when **Val 1 Concentration** or **Val 2 Concentration** is set to a value greater than 0.

```

<SET PARAMETER MODE>
Validation Allowance
10.00000
% of val concentra

```

#### 4.50 Validation Wait Time

The **Validation Wait Time** parameter sets the amount of time (in seconds) for the validation gas to purge the system at the beginning of the validation. Because validation gas may be introduced into the system at various distances from the analyzer, adjustment of the **Validation Wait Time** parameter is necessary to optimize the time the validation gas is allowed to purge through the transport tubing before the analyzer makes a validation measurement. Optimization of the **Validation Wait Time** parameter ensures an accurate measurement of the validation gas while minimizing gas consumption. Enter the required value.

```

<SET PARAMETER MODE>
Validation Wait Time
60
Enter a value (secs)

```

#### 4.51 Val Interval


The **Val Interval** parameter sets the number of days between autovalidation cycles. The next scheduled validation cycle would occur in **Val Interval** days at the **Val Start Time**. Enter the required value.

```

<SET PARAMETER MODE>
Val Interval
1
Enter a value (days)

```

## 4.52 Val Perm Constant Kp

The **Val Perm Constant Kp** parameter is used for permeation validation devices and defines the system constant that is determined at the factory during calibration. Using the system constant, the permeation device can be replaced with another permeation device with a different permeation rate, and the correct new permeation concentration is calculated by the analyzer software. The system constant Kp will be constant over the life of the analyzer provided the temperature, sample flow rate and pressure of the system are not changed from the factory settings. If the system constant needs to be reset, refer to *Setting the Kp value* →  for details on recalculating the system constant.

```
<SET PARAMETER MODE>
Val Perm Constant Kp
0.24
0:Off >0:System Cons
```

## 4.53 Val Perm Rate Rp

The **Val Perm Rate Rp** parameter is used for permeation validation devices and defines the permeation rate in ng/min referenced on the permeation device certification. This certification is valid for a period of one (1) year. However, the permeation device may be used longer than that period if a factory certified validation concentration is not required. When the validation concentration begins to drop steadily, the permeation device must be replaced. For details on replacing the permeation device, refer to the operating instruction.

```
<SET PARAMETER MODE>
Val Perm Rate Rp
0.33
0:Off >0:ng/min
```

## 4.54 Val start time

The **Val Start Time** parameter sets the hour of the day for the daily validation to begin. Enter the required value.

```
<SET PARAMETER MODE>
Val Start Time
11
Hour of day (0-23)
```

## 4.55 Zero val tolerance

The **Zero Val Tolerance** parameter is used to set the maximum acceptable reading when validating with zero gas. To configure the analyzer for zero gas set the parameter **Val 1 Concentration** or **Val 2 Concentration** to 0.0. Enter the required value.

```
<SET PARAMETER MODE>
Zero Val Tolerance
60.0
Enter a value (ppmv)
```

## 4.56 Adjusting analyzer reading to match specific standard(s)

In some instances, the user may wish to adjust the analyzer reading to match the concentration (or concentrations) of a specific standard (or standards). The **RATA Multiplier** and **RATA Offset** parameters are used to adjust the analyzer output in the field without affecting the factory calibration. Both parameters are used when samples from two different concentration standards are available, whereas only the **RATA Multiplier** parameter is used when a non-zero gas sample from only one concentration standard is available. If using a zero gas sample from only one concentration standard, then only the **RATA Offset** parameter should be calculated.

The value of the **RATA Multiplier** parameter,  $S$ , is determined by

$$S = \frac{C_2 - C_1}{A_2 - A_1},$$

where  $C_1$  is the certified concentration of standard No. 1,  $C_2$  is the certified concentration of standard No. 2,  $A_1$  is the measured concentration (analyzer reading) of standard No. 1 without any RATA adjustment, and  $A_2$  is the measured concentration (analyzer reading) of standard No. 2 without any RATA adjustment.

The **RATA Offset** parameter,  $O$ , is determined by

$$O = C_1 - (S \cdot A_1),$$

where  $S$  can be 1 when a sample from only one concentration standard is available.

For a non-zero single concentration standard **RATA Multiplier** parameter,  $S$  is determined by

$$S = (C_1 - O) / A_1$$

where  $O$  can be zero, if desired.

After an automatic, semi-automatic, manual **Mode 7** or manual **Mode 8** validation completes, the analyzer automatically calculates new **RATA Multiplier** and **RATA Offset** values. These values are based on the number of validations that the analyzer is configured to accept and the type of validation used.

To perform this calculation, the most recent validation result(s) will be used. These calculations are based on the average measurement values during the validation, which can be viewed from the **Mode 9** display. These values are not constrained by the measurement range of the analyzer, which will ensure accurate **RATA Multiplier** and **RATA Offset** values are calculated.

## 4.57 To perform the calculation

If RATA is enabled, the current **RATA Multiplier** and **RATA Offset** values must be removed from the measured Validation 1 and/or Validation 2 concentration values. Depending on the number of validations, or the validation type, one of the following scenarios occur:

- If using a non-permeation single validation system with a zero gas as the standard, then a new **RATA Offset** is calculated leaving the **RATA Multiplier** at its previous value.
- If using a non-permeation single validation system with a non-zero gas as the standard, then a new **RATA Multiplier** is calculated leaving the **RATA Offset** at its previous value.
- If using a permeation-based single validation system, then a new **RATA Multiplier** is calculated and the **RATA Offset** is left at its previous value.
- If using a dual validation system, then both a new **RATA Multiplier** and **RATA Offset** are calculated.


### To adjust the analyzer reading

1. Validate the analyzer using one or two concentration standards (refer to *Validating the analyzer* → .



*Endress+Hauser recommends validating the analyzer using only the analyte mixed in the validation gas specified on the analyzer calibration certificate. A bottle of test gas with certified concentrations of approximately 20% and 80% of full scale are recommended for a two point validation. For a single point validation, a bottle with a certified concentration of approximately 50% of full scale should be used.*

*When procuring a gas standard, make sure the background gas is that specified or a mix that closely resembles the contents of the process stream and have the gas standard certified to better than the specified precision of the analyzer, if possible.*

2. Enter **Mode 2** by pressing the # key followed by the 2 key. The LCD prompts for a numeric password.
3. Enter the user password (3142) on the keypad, then press the \* key.
4. View the newly calculated **RATA Multiplier** and **RATA Offset** parameters from the **Update RATA** parameter or calculate the **RATA Multiplier** and/or **RATA Offset** parameter(s) manually using the equations above.
5. Follow the procedure under *To change parameters in Mode 2* →  to enter the new values.
6. Confirm the new values by re-measuring the bottle(s) of test gas.



*RATA values are also applied to the validation measurements. If RATA free validation values are required, the RATA parameter must be disabled before running the validation.*

## 4.58 Application examples

### 4.58.1 To set manual dual validation

Two standards are used in this example, Validation 1 and Validation 2, which are manually introduced into the analyzer. **Mode 7** and **Mode 8** are used to run these standards.

1. Configure the **Operator Parameter** section with the **Operator Password** set to **0** and one parameter.
  - Configure **Update RATA** by setting **Operator Parameter01** to **225**. Other parameters can be added, if desired.
2. Introduce Validation 1 and press # followed by the 7 key (to enter **Mode 7**) to allow Validation 1 to run for the desired amount of time.
3. Introduce Validation 2 and press # followed by the 8 key (to enter **Mode 8**) to allow validation to run for the desired amount of time.
4. Press the # key followed by the 2 key (to enter **Mode 2**) and then the \* key.
5. View the newly calculated RATA values, and if desired, set **Update RATA** to **1** accept the changes. Leave the setting at **0** to reject the changes and start over.
6. Re-run steps 2 and 3.
7. Press the # key followed by the 9 key (to enter **Mode 9**) to verify the validation results and confirm that new RATA values are operating correctly.
8. Press the # key followed by the 1 key (to enter **Mode 1**) to return to Normal Mode.

### 4.58.2 To set semi-automatic single or dual validation

In this scenario, either one or two standards (Validation 1 and/or Validation 2) are used, which are automatically introduced and controlled by the analyzer. Typically, the validation is initiated locally by the user or while the user is present by initiating the **Start Validation** parameter or the Start Validation digital input.

1. Configure the **Operator Parameter** section with the **Operator Password** set to **0** and two parameters.
  - a. Configure **Start Validation** by setting Operator Parameter01 to **71**.
  - b. Configure **Update RATA** by setting Operator Parameter02 to **225**. Other parameters can be added, if desired.
2. Press the # key followed by the 2 key (to enter **Mode 2**) and then press the \* key.
3. Set the **Start Validation** parameter to **1** and then press the \* key followed by the # and the 1 key to allow the validation to start. Allow the validation sequence to complete.



4. Press the **#** key followed by the **2** key (to enter **Mode 2**) and then press the **\*** key twice.
5. View the newly calculated RATA values, and if desired, set **Update RATA** to **1** to accept the changes. Leave the setting at **0** to reject the changes and start over.
6. Re-run steps 2 through 4.
7. Press the **#** key followed by the **9** key (to enter **Mode 9**) to verify the validation results and confirm that new RATA values are operating correctly.
8. Press the **#** key followed by the **1** key (to enter **Mode 1**) to return to Normal Mode.

### 4.58.3 Automatic single or dual validation


Either one or two standards can be used for automatic single or dual validation; Validation 1 and/or Validation 2, which are automatically introduced and controlled by the analyzer. The validation is automatically initiated based on the hour of the day and is controlled by the **Val Start Time**, **Daily Validation** and **Val Interval** parameters. Validation can also be initiated remotely using the **Start Validation** parameter or the **Start Validation** digital input.

1. Configure the **Operator Parameter** section with the **Operator Password** set to **0** and one parameter.
  - a. Configure **Update RATA** by setting **Operator Parameter01** to **225**. Other parameters can be added, if desired.
2. Press the **#** key followed by the **9** key (to enter **Mode 9**) to verify the validation results.
3. Press the **#** key followed by the **2** key (to enter **Mode 2**) and then press the **\*** key.
4. View the newly calculated RATA values, and if desired, set **Update RATA** to **1** to accept the changes. Leave the setting at **0** to reject the changes and start over.
5. Press the **#** key followed by the **1** key (to enter **Mode 1**) to return to Normal Mode.

## 4.59 Validating the analyzer

Validation of the analyzer using an appropriate gas standard is automatically conducted at each **Val Interval** period at the **Val Start Time**, semi-automatically when initiated via the **Validation DI** or the **Start Validation** parameter, or manually by accessing **Mode 7** or **Mode 8**.

### 4.60 To validate automatically



1. Verify that the validation gas source(s) has been properly installed and/or connected.
2. If necessary, set the current time, date, desired validation hour and validation interval (see *To change parameters in Mode 2* → )
3. Set the **Daily Validation** parameter to **1**. The analyzer should run a validation cycle for the number of days and hour set by the **Val Interval** and **Val Start Time** parameters.

### 4.61 To validate semi-automatically

1. Verify that the validation gas source(s) has been properly installed and/or connected.
2. Initiate a validation cycle by closing the contacts connected to the **Validation DI** input or by setting the **Start Validation** parameter to **1**.

### 4.62 To validate manually

1. Verify that the validation gas source(s) has been properly installed and/or connected.
2. Initiate validation measurements by pressing the **#** key followed by the **7** key (**Mode 7**) or the **#** key followed by the **8** key (**Mode 8**) for a dual validation system.
3. **Once** validation measurements are complete, press the **#** key followed by the **1** key (**Mode 1**) to return to Normal Mode and stop the validation.

Once a validation measurement has been completed, the appropriate relay (Val #1 Active or Val #2 Active) will be activated. If the concentration measured does not fall within the allowable limits (refer to *Validation allowance* → ) , the **Validation Fail Alarm** relay will activate. Once activated, the **Validation Fail Alarm** must be manually canceled (refer to *Cancel Val Alarms* → ) .

### 4.63 Scaling and calibrating the current loop signal

The 4-20 mA current loop signals are most conveniently scaled and calibrated at the receiving end (RTU, flow computer, etc.).




*The 4-20 mA current loop output is factory set to source current. To change the 4-20 mA current loop output from source to sink, refer to the section called “Changing the 4-20 mA Current Loop Mode” in the operating instruction.*

To scale the receiver's output, the analyzer's current loop output is forced to 4 mA (0%) and 20 mA (100%) using the **4-20 mA Test** parameter. The receiver is adjusted to read “0” and “Full Scale,” respectively.



*Be sure to work in a non-hazardous area while handling any electrical connector.*

To scale the current loop signal

1. Make sure the current loop is connected and the receiver is set for the analyzer to source the current.
2. Set the **4-20 mA Test** parameter to 0% (see *To change parameters in Mode 2* → )
3. Enter **Mode 5** by pressing the # key followed by the 5 key to force the loop current to 4 mA.
4. Adjust the receiver calibration control to read the appropriate value. A current loop output of 4 mA represents the value set in **AO 4 mA Value**.
5. Set the **4-20 mA Test** parameter to 100%.
6. Enter **Mode 5** by pressing the # key followed by the 5 key to force the loop current to 20 mA.
7. Adjust the receiver calibration controls for the appropriate value. A current loop output of 20 mA represents the value set in **AO 20 mA Value**.
8. If needed, repeat steps 2-7 to obtain an accurate calibration over the range.
9. After obtaining an accurate calibration of the current loop receiver, press the # key followed by the 1 key to return to **Normal Mode**.



*When the # key is pressed, measurement will be suspended until a new mode is established. The only modes that produce measurements are **Mode 1**, **Mode 6**, **Mode 7** or **Mode 8**.*

## 5 Warnings

Warnings messages appear on the front panel LCD and are transmitted via RS-232. Warnings may include one or more of the following:


- **Fitting out of range:** This warning occurs when the system is unable to adequately fit a curve to the measured signal typically as a result of too much noise in the signal or an unexpected gas mixture in the measurement cell.
- **Peak tracking:** This warning indicates when a peak tracking correction has occurred.

### 5.1 Alarms

The analyzer is equipped with three dry contact relays that indicate a system fault or alarm state, the **General Fault Alarm** relay, the user **Assignable Alarm** relay and the **Validation Fail Alarm** relay. Refer to the system drawings for this analyzer for relay assignments.

In addition, alarm and fault messages appear on the front panel LCD and are transmitted via RS-232.

#### 5.1.1 System Faults

The **General Fault Alarm** is triggered by system faults, which cause the **General Fault Alarm** relay to be activated and the current loop to respond according to the **4-20mA Alarm Option** setting. Once activated, the **General Fault Alarm** can be reset via the **General Alarm DO** parameter (see *Changing Measurement and Control Parameters* → )

System faults include one or more of the following:

- **Fitting Restart Alarm:** This fault occurs when the number of consecutive system restarts caused by the system's inability to adequately fit a curve to the measured signal exceeds a pre-set limit.
- **Flow Switch Alarm:** This fault occurs on systems with a digital input flow switch enabled and the digital input triggers the alarm state.
- **Laser Current High Alarm:** This fault occurs when the laser current goes above the maximum allowable indicating a potential problem with the laser.
- **Laser Current Low Alarm:** This fault occurs when the laser current goes below the minimum allowable indicating a potential problem with the laser.
- **Laser Power High Alarm:** This fault occurs when the DC signal is saturated typically as a result of the absence of absorbing gas in the sample cell.
- **Laser Power Low Alarm:** This fault occurs when the DC signal becomes too weak for a reliable measurement typically as a result of mirror contamination.
- **Laser Zero High Alarm:** This fault occurs if the detector signal value is above the set normal range when the laser is turned off.
- **Laser Zero Low Alarm:** This fault occurs if the detector signal value is below the set normal range when the laser is turned off.
- **PeakTk Restart Alarm:** This fault occurs when the number of consecutive system restarts caused by a peak tracking correction exceeds a preset limit.
- **Pressure High Alarm:** This fault occurs when the pressure in the sample cell exceeds the specified maximum operating pressure.
- **Pressure Low Alarm:** This fault occurs when the pressure in the sample cell is below the specified minimum operating pressure.
- **Temp High Alarm:** This fault occurs when the temperature in the measurement cell exceeds the specified maximum operating temperature.
- **Temp Low Alarm:** This fault occurs when the temperature in the measurement cell is below the specified minimum operating temperature.



For systems with heated enclosures, a **Temp Low Alarm** or **Temp too High Alarm** fault will activate the **General Fault Alarm** when the enclosure temperature is more than 5 °C above or below the specified temperature (refer to the system drawings or calibration report for this analyzer). Once the enclosure has reached the specified temperature, reset the **General Fault Alarm** (see *To change parameters in Mode 2* → ).

- **Validation 1 Failed/Validation 2 Failed Alarm:** An additional alarm for systems equipped with autovalidation that is triggered when the measured concentration of the validation 1 or 2 gas does not agree with the user defined allowable limits. These alarms also trigger the Validation Fail dry contact relay. Refer to *Validation Allowance* → . Once activated, the **Validation Fail Alarm** must be manually reset via the **Cancel Val Alarms** parameter (see *Cancel Val Alarms* → ).

Refer to Appendix A for recommendations and solutions to common problems resulting in a system fault.

### 5.1.2 User alarms

User alarms are generated based on measurement readings and their relation to **Mode 2** parameter settings. They include the following:

- **Concentra High Alarm:** This fault occurs when the measured concentration is above the limit set with the **High Alarm Setpoint** parameter (see *High Alarm Setpoint* → ).
- **Concentra Low Alarm:** This fault occurs when the measured concentration is below the set limit with the **Low Alarm Setpoint** (see *Low Alarm Setpoint* → ).

### 5.1.3 Assignable alarm

The functionality of the **Assignable Alarm** is determined by the **DO Alarm Setup** parameter set in **Mode 2** according to the Table. For example, the **Assignable Alarm** can be configured as a **Concentra High Alarm** or **Concentra Low Alarm** that is triggered when the measured concentration is above or below, respectively, the level set in **Mode 2**. A high concentration causes the **Assignable Alarm** relays to be activated and the message “Concentration High” displays on the LCD screen.

## 5.2 Validating the analyzer

Validation of the analyzer using an appropriate gas standard is automatically conducted at each **Val Interval** period at the **Val Start Time**, semi-automatically when initiated via the Validation DI or the **Start Validation** parameter, or manually by accessing **Mode 7** or **Mode 8**.

### 5.2.1 To validate automatically

1. Verify that the validation gas source(s) has been properly installed and/or connected.
2. If necessary, set the current time, date, desired validation hour and validation interval (see *To change parameters in Mode 2* → ).
3. Set the **Daily Validation** parameter to **1**. The analyzer should run a validation cycle for the number of days and hour set by **Val Interval** and the **Val Start Time** parameter.

### 5.2.2 To validate semi-automatically

1. Verify that the validation gas source(s) has been properly installed and/or connected.
2. Initiate a validation cycle by closing the contacts connected to the Validation DI input or by setting the **Start Validation** parameter to **1**.



*The keypad is disabled when Validation DI is active.*

### 5.2.3 To validate manually

1. Verify that the validation gas source(s) has been properly installed and/or connected.
2. Initiate validation measurements by pressing the # key followed by the 7 key (**Mode 7**) or the # key followed by the 8 key (**Mode 8**) for a dual validation system.
3. Once validation measurements are complete, press the # key followed by the 1 key (**Mode 1**) to return to Normal Mode and stop the validation.

If the **4-20 mA Val Action** parameter is set to **1**, the 4-20 mA signal will output validation measurements and the appropriate relay (Val #1 Active or Val #2 Active) will be activated. If the concentration measured does not fall within the allowable limits during an automatic or semi-automatic validation (see *Validation Allowance* → ☰), the **Validation Fail Alarm** relay will activate. Once activated, the **Validation Fail Alarm** must be manually canceled (see *Cancel Val Alarms* → ☰). Initiating a new automatic, semi-automatic or manual validation will clear the Validation Fail Alarm so that the new validation can determine its state.



*Endress+Hauser recommends validating the analyzer using only the analyte mixed in the validation gas specified on the analyzer calibration report. A bottle of test gas with a certified concentration representing 50% of full scale (for single validation systems) or bottles representing 20% and 80% of full scale (for dual validation systems) are recommended.*



*When procuring a gas standard, make sure the background gas is that specified or a mix that closely resembles the contents of the process stream and have the gas standard certified to better than the specified precision of the analyzer, if possible.*

## 5.3 Calibrating the analyzer

Calibrating the analyzer is typically not required under normal circumstances. Endress+Hauser calibrates each analyzer to a National Institute of Standards and Technology (NIST) traceable standard before shipping the unit to the end user. Because Endress+Hauser analyzers use a non-contact form of measurement, they are relatively insensitive to contamination, are quite rugged and virtually maintenance free ensuring years of reliable service.

## 6 Switching Stream Compositions

Some analyzers may be configured with dual stream compositions. To switch between the two calibration methods, use the analyzer keypad to change the system programming. Refer to the following steps.

### 6.1 To measure Stream 1

1. From the analyzer keypad, press the # key followed by the 2 key to enter the Set Parameter Mode (**Mode 2**).
2. Enter the password (**1688**).
3. Scroll through the parameters until the parameter, “Background to Use,” displays.
4. Press 0 (PrCs) and the ENTER key.
5. Press the # key followed by the 1 key to begin measurement.

### 6.2 To measure Stream 2



*This measurement is set as default from the factory.*

1. From the analyzer keypad, press the # key followed by the 2 key to enter the Set Parameter Mode (**Mode 2**).
2. Enter the password (**1688**).
3. Scroll through the parameters until the parameter, “Background to Use,” displays.
4. Press 1 (Val) and the ENTER key.
5. Press the # key followed by the 1 key to begin measurement.



*Refer to the calibration reports provided with this shipment for information on the stream calibrations.*



**Return analyzer to Stream 1 after changing to alternate stream. The system MUST be reset to Stream 1 for accurate measurement.**

## 7 Serial port communications

### 7.1 Receiving serial data (Customer port output)

When the Modbus Mode parameter is set to 0, the analyzer is configured to transfer a string of data from the analyzer to a serial device via the customer port output. The receiving device is typically a computer terminal running HyperTerminal, which is a program included with Microsoft® Windows® that enables serial communication and the viewing, capturing and storage of serial port data and messages.

#### 7.1.1 To launch HyperTerminal

1. On your Windows desktop, click Start followed by Run (usually located in the lower right window of the Start Menu).
2. Type Hypertrm.exe and hit Return to launch HyperTerminal.



*For quicker access to HyperTerminal, save a HyperTerminal shortcut to the desktop.*

3. Once HyperTerminal is activated, the Connection Description window appears, as shown in Figure 4. Type in a Filename (where the terminal session settings will be stored for future recall) and click on any icon. Click OK.
4. The Connect To window appears prompting for a connection, as shown in Figure 5. Click the Menu Arrow under Connect Using to view the choices.
5. Click on the appropriate port to which your analyzer is connected (COM1, COM2, COM3, etc.). Click OK.
6. Once the port is chosen, the COM Properties window appears. Make sure the COM properties for the port selected reflect those shown in Figure 6 (19200 baud or as set in Mode 2, 8 data bits, 1 stop bit, no parity, and no flow control).
7. Click OK to establish the connection.

##### 7.1.1.1 Mode 1 data string

Once connected, the data will start streaming through the HyperTerminal Window as shown in the figure below. The data string is tab delimited (each row starting with a tab) forming 23 columns in the following order:

- **Date:** Current date (in MM:DD:YY)
- **Time:** Current time (in HH:MM:SS)

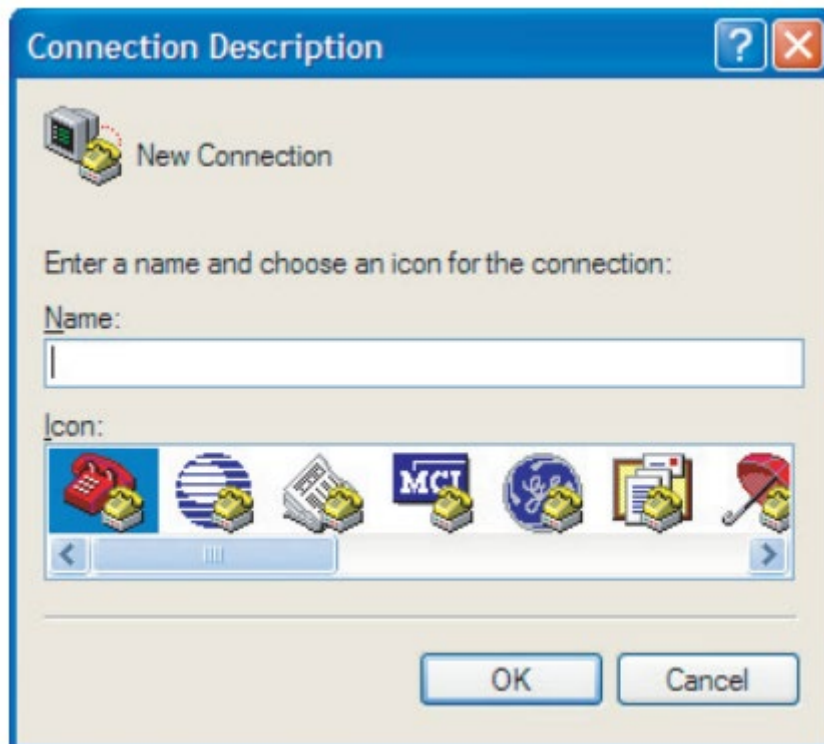


Figure 3. Connection description window



Figure 4. Connect to window



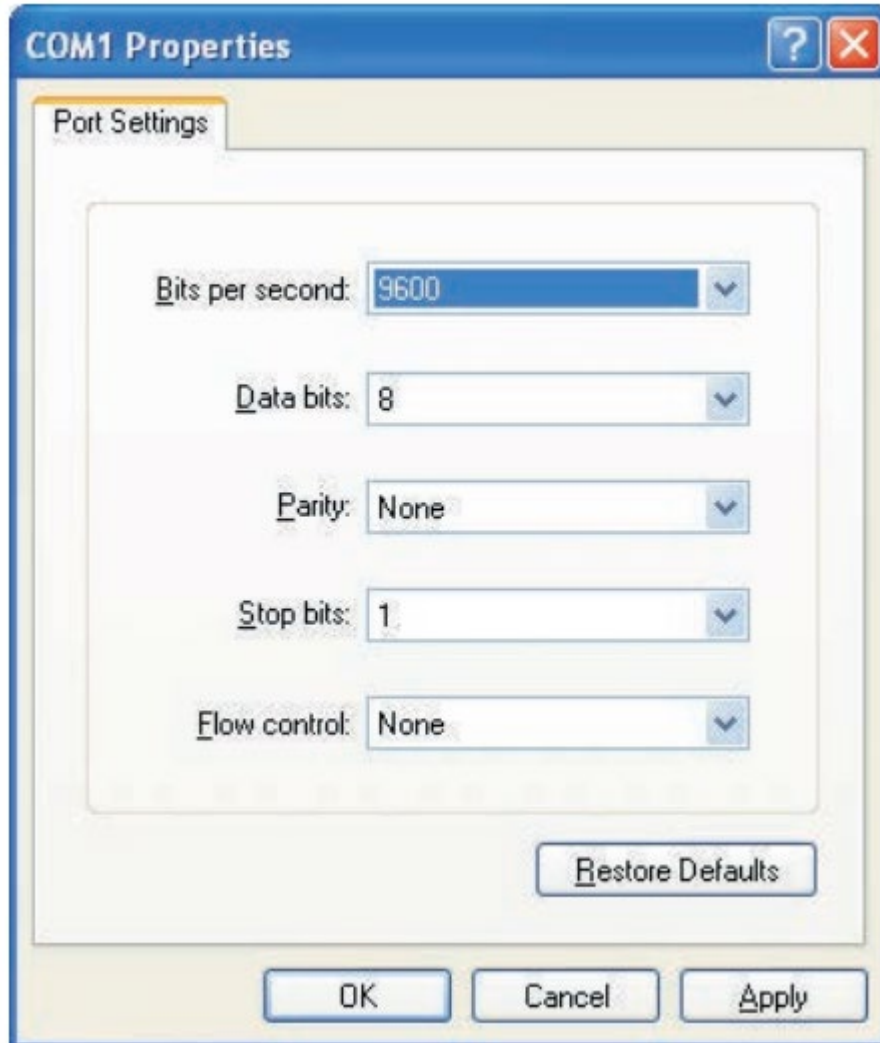
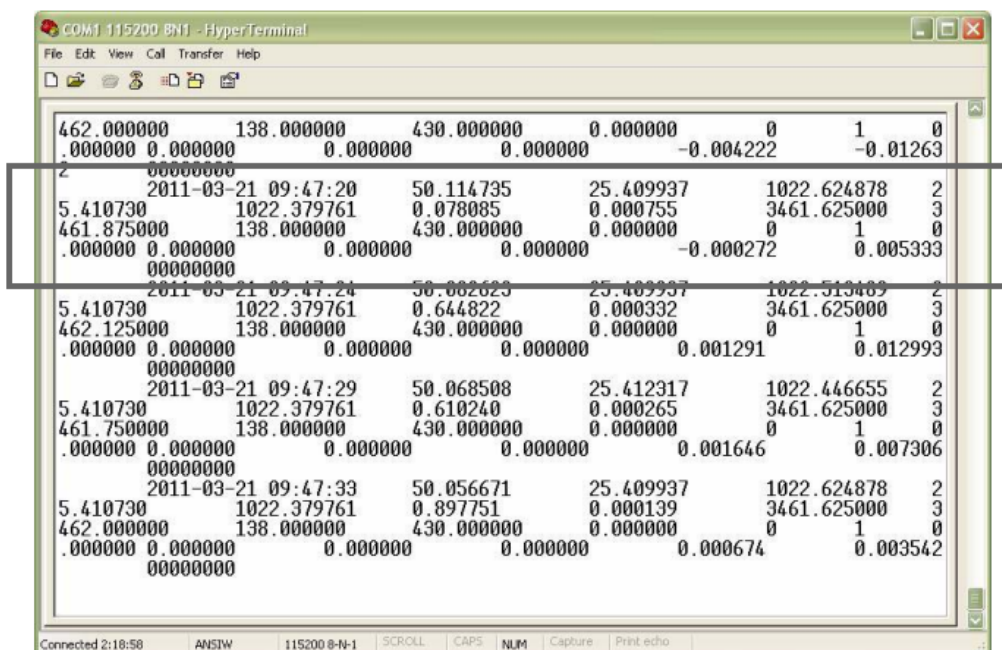


Figure 5. COM properties window



Refer to data output headings in Figure 7.; reading left to right.

Figure 6. Hyperterminal window with streaming data

The data string is tab delimited (each row starting with a tab) forming 23 columns in the following order:

- **Concentration (ppmv):** Current measured analyte concentration (ppmv).
- **Wet Temp (C):** Current temperature of the gas sample (degrees C) when normal sample gas is flowing.
- **Wet Pressure (mb):** Current pressure of the gas sample (mb) when normal sample gas is flowing.
- **Dry Temp:** Current temperature (0.0 for non-differential units) of the gas sample (degrees C) when scrubbed sample gas is flowing.
- **Dry Pressure:** Current pressure (0.0 for non-differential units) of the gas sample (mb) when scrubbed sample gas is flowing.
- **Fit Residue:** Value ranging from 0 to 1 indicating how well the measured spectrum fits the reference spectrum, where 1 represents a perfect match.
- **Fit Ratio:** Ratio of the measured spectrum versus the Reference 1 spectrum.
- **Dry DC:** Signal level (laser intensity in counts, 0.0 for non-differential units) at the high end of the current ramp during the dry cycle.
- **Wet DC:** Signal level (laser intensity in counts) at the high end of the current ramp during the wet cycle.
- **Peak Index:** Peak index of the measured spectrum.
- **Ref Index:** Peak index used for reference.
- **Index Difference:** Difference between measured and reference peak indices, where a value other than 0 indicates peak tracking is functioning.
- **Val Flg:** Indicates current stream being measured (0 = Process, 1 = Val 1, 2 = Val 2).
- **Process Path Flg:** Calculation path (reference spectra) used for the concentration calculation (0 = Process Reference Spectra, 1 = Validation Reference Spectra).
- **Current Midpoint:** Current midpoint that the analyzer is using, including any peak tracking adjustments.
- **Fit Ratio 2:** Ratio of the measured spectrum versus the Reference 2 spectrum, where a value of 0 indicates that the Reference 2 spectrum was not used in the calculation of concentration.
- **Fit Ratio 3:** Ratio of the measured spectrum versus the Reference 3 spectrum, where a value of 0 indicates that the Reference 3 spectrum was not used in the calculation of concentration.
- **Fit Ratio 4:** Ratio of the measured spectrum versus the Reference 4 spectrum, where a value of 0 indicates that the Reference 4 spectrum was not used in the calculation of concentration.
- **Fit Ratio 5:** Ratio of the measured spectrum versus the Reference 5 spectrum, where a value of 0 indicates that the Reference 5 spectrum was not used in the calculation of concentration.
- **Fit Ratio Dry:** Ratio of the measured spectrum versus the Reference Dry spectrum, where a value of 0 indicates that the Reference Dry spectrum was not used in the calculation of concentration.
- **Fit Ratio Dry-1:** Ratio of the measured spectrum versus the Reference Dry spectrum shifted by 1 index value, where a value of 0 indicates that the Reference Dry spectrum shifted by 1 index value was not used in the calculation of concentration.
- **Alarm Flags:** Value representing the status of each individual alarm in the analyzer, as listed in the Table.

Any alarm messages will be transmitted along with the data string and will appear in a separate row.




*The number of seconds between each line of data output should be the # Spectrum Average number set in Mode 2 divided by 4. The factory default setting of 16 for # Spectrum Average results in a line of output each 4 seconds.*

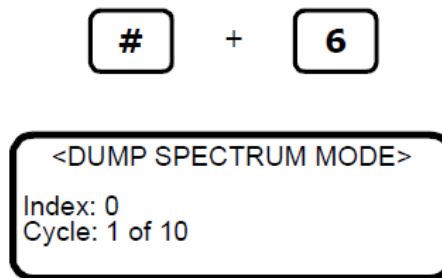
### 7.1.2 To capture and save data from the serial port

1. To save the data from the serial port, use the Transfer/Capture Text function and enter the Filename to where you would like to store the captured data.
2. To stop the capture of the serial data, click on Transfer/Capture Text/Stop.

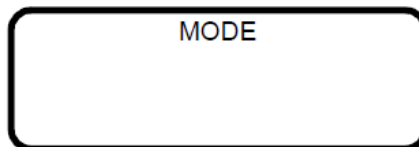
### 7.1.3 To read diagnostic data with HyperTerminal

1. Before entering Mode 6, make sure the serial port on the computer used for serial communication is connected to the analyzer and the output stream is showing on the screen as described in To launch HyperTerminal → .

2. To save the data from the serial port, use the Transfer/Capture Text function and enter the Filename to where you would like to store the captured data.
3. Once capturing is in place, enter Mode 6 by pressing # key followed by the 6 key.



The **index** shown on the LCD display counts by 50's from 0 to 511. The analyzer will repetitively output this information until the # button is pressed or the number of cycles completes. At the end of the data dump, the screen will display:



4. Press the # key followed by the 1 key to return to **Mode 1**.
5. Once normal operation resumes, stop the capture of the serial data. To stop the capture of the serial data, click on **Transfer/Capture Text/Stop**. The resulting data files contain the downloaded data as shown in Figure 3–5.

#### 7.1.3.1 Mode 6 data

The 20 columns of tab delimited data in the file resulting from a Mode 6 data dump are labeled as follows:

- Index: Index value of points on spectrum scan curve.
- DC Dry: Dry DC spectrum of sample gas (0.0 for non-differential units).
- DC Dry Ref 1: Reference 1 dry DC spectrum.
- DC Wet: Wet DC spectrum of sample gas.
- DC Wet Ref 1: Reference 1 wet DC spectrum.
- 2f Dry: Dry AC spectrum of sample gas (0.0 for non-differential units).
- 2f Dry Ref 1 Pdry/Pwet: Reference 1 dry AC spectrum based on wet pressure.
- 2f Wet: Wet AC spectrum of sample gas.
- 2f Wet Ref 1 Pwet: Reference 1 wet AC spectrum based on wet pressure.
- 2f: AC spectrum of sample gas.
- Ref 1: Reference 1 AC spectrum.
- Ref 2: Reference 2 AC spectrum.
- Ref 3: Reference 3 AC spectrum.
- Ref 4: Reference 4 AC spectrum.
- Ref 0: Reference 0 AC spectrum.
- Ref 0 RT: Reference 0 real-time AC spectrum.
- Ref Val: Reference Validation AC spectrum.

```

<DUMP SPECTRUM MODE>
Date:2016-5-14| Time:14:55:54
SpectraSensors Inc
TDL Analyzer
1100002175.D
FS 5.16-G205

Cycle: 1 of 10


Dry DC Date & Time Concentration Wet Temp Wet Pressure Dry Temp Dry Pressure Fit Residue Fit Ratio
Fit Ratio 3 DC Index Ref Index Ref Index Difference Val Flg Process Path Flg Current Midpoint Fit Ratio 2
2014-10-17 14:56:15 0.0000 20.630304 1011.550171 20.625299 1011.862122 0.758966 0.066575
0.312500 0.312500 409.000000 279.000000 0.000000 0.000000 0 1 70.000000 0.000000 0.000000
0.000000 0.000000 -0.973848 0.000000 0.000000

Index DC Dry DC Dry Ref 1 DC wet DC wet Ref 1 2f Dry 2f Dry Ref 1 Pdry/Pwet 2f wet 2f wet Ref 1 Pwet 2f Composite 2f Ref 1
Ref 2 Ref 3 Ref 4 Ref 0 Ref 0 RT Ref Val 2f Dry Ref Val Pdry/Pwet 2f wet Ref Val Pwet 2f Composite Ref 1
0 0.375000 0.000000 0.000000 0.000000 0.500000 0.000000 0.000000 -42909.093750 0.000000 0.000000 -23555.556641 0.000000 0.000000
0.000000 0.000000
1 0.250000 0.000000 0.000000 0.250000 0.000000 0.000000 -37818.183594 0.000000 0.000000 -20888.888672 0.000000 0.000000
0.000000 0.000000
2 0.187500 0.000000 0.000000 0.250000 0.000000 0.000000 -32000.000000 0.000000 0.000000 -19555.556641 0.000000 0.000000
0.000000 0.000000
3 0.125000 0.000000 0.000000 0.312500 0.000000 0.000000 -28363.636719 0.000000 0.000000 -16888.888672 0.000000 0.000000
0.000000 0.000000
4 0.250000 0.000000 0.000000 0.000000 0.000000 0.000000 -24727.273438 0.000000 0.000000 -14666.666992 0.000000 0.000000
0.000000 0.000000
5 0.250000 0.000000 0.000000 0.062500 0.000000 0.000000 -21818.181641 0.000000 0.000000 -12000.000000 0.000000 0.000000
0.000000 0.000000
6 0.125000 0.000000 0.000000 0.000000 -0.062500 0.000000 0.000000 -18181.818359 0.000000 0.000000 -11111.111328 0.000000 0.000000
0.000000 0.000000
7 0.000000 0.000000 0.000000 0.187500 0.000000 0.000000 0.000000 -16727.273438 0.000000 0.000000 -8888.888672 0.000000 0.000000
0.000000 0.000000
8 0.062500 0.000000 0.000000 0.062500 0.000000 0.000000 0.000000 -14545.455078 0.000000 0.000000 -8000.000000 0.000000 0.000000
0.000000 0.000000
9 0.125000 0.000000 0.000000 0.187500 0.000000 0.000000 0.000000 -11636.364258 -461.782318 -8000.000000 -10181.587891 0.000000
4348.125000 -9719.805664 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
10 0.062500 0.000000 0.000000 0.125000 0.000000 0.000000 0.000000 -11636.364258 -651.170105 -7111.111328 -9274.558594 0.000000
3607.163818 -8623.388672 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
11 0.062500 0.000000 0.000000 -0.062500 0.000000 0.000000 -12363.636719 -857.883789 -5777.777832 -8534.494141 0.000000
3079.392578 -7676.610352 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000 0.000000

```

Figure 7. Sample diagnostic data output

- 2f Dry Ref Val Pdry/Pwet: Reference Validation dry AC spectrum based on wet pressure.
- 2f Wet Ref Val Pwet: Reference Validation wet AC spectrum based on wet pressure.
- 2f Composite: Recreated AC spectrum based on the reference curve fitting ratios.

You can import the stored data file into a spreadsheet program such as Microsoft Excel to plot the data (see *Viewing diagnostic data with Microsoft Excel* →  for more information.)

## 7.2 Viewing diagnostic data with Microsoft Excel

A spreadsheet program such as Microsoft Excel can import the data collected in the Mode 6 data dump for viewing and plotting.

### 7.2.1 To import the data file into Excel

1. In Excel, click **Open** and choose the name of the spectrum file saved while in **Mode 6**. Be sure to select **All Files (\*.\*)** under **Files of type:** while searching, as shown in the figure below.

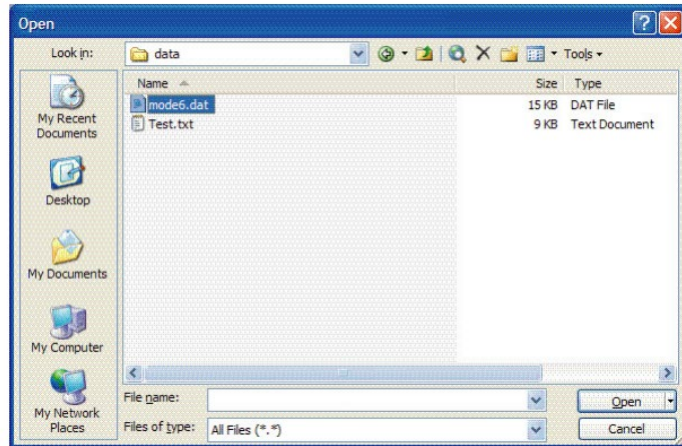


Figure 8. Opening a data file in Excel

2. The **Text Import Wizard** should open. Choose the **Delimited** option and click **Next**, as shown in Figure 10.
3. Under **Delimiters**, choose the **Tab** and **Space** options, check the **Treat Consecutive Delimiters as One** box, as shown in Figure 10, and then click **Finish** to display the spreadsheet.

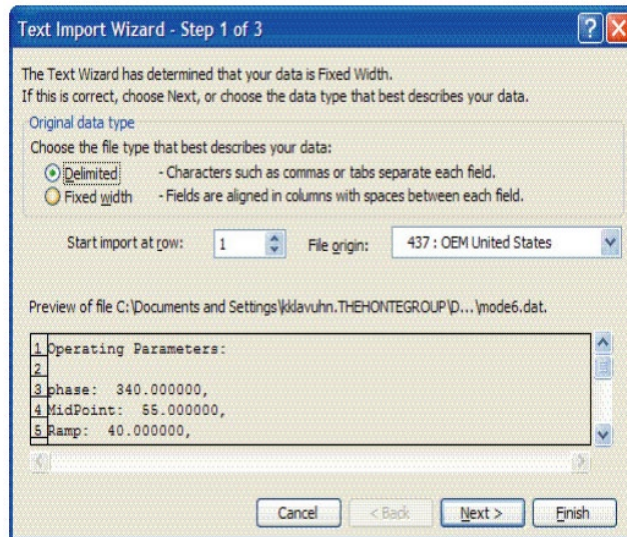


Figure 9. Setting data type in Text Import Wizard

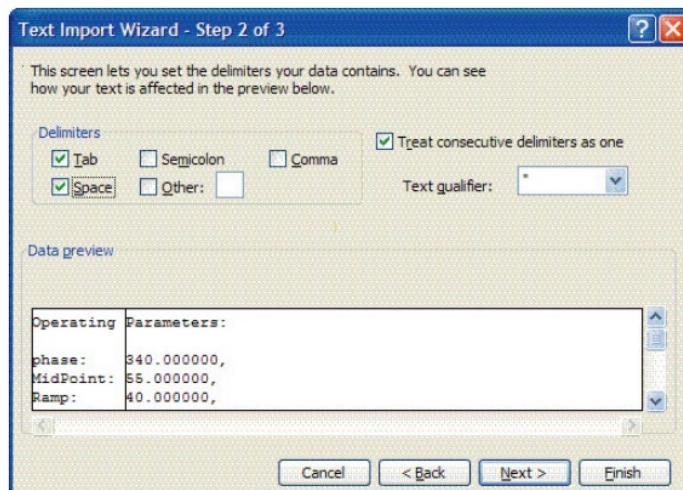


Figure 10. Setting Tab and Space as delimiters

The first few lines look like the normal serial output data received before the **Mode 6** command was entered. Look for the three columns of numbers at the bottom of the file.

- Click on the upper right cell of the three columns, as shown in Figure 3–9. Hold the **Shift** key down while pressing the **End** key followed by the **Down Arrow** key to highlight the third column. Keep holding down the **Shift** key and press the **End** key followed by the **Left Arrow** key to select the three columns by 512 rows.

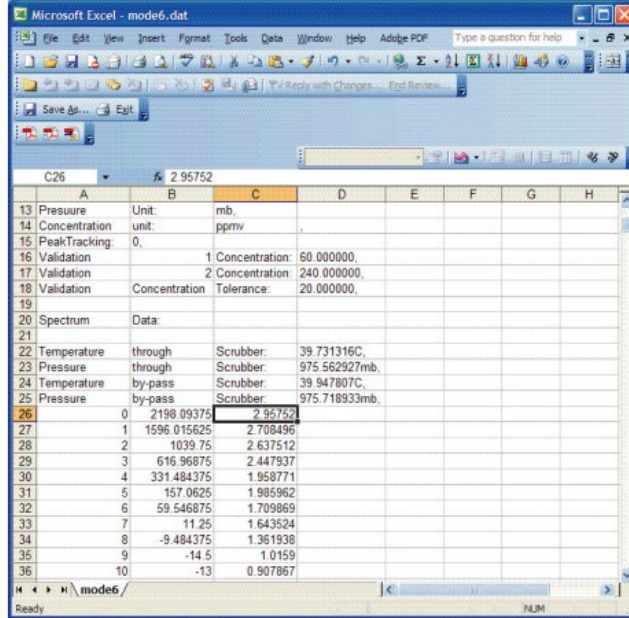


Figure 11. Highlighting imported data for plotting in Excel

- Click the Chart Wizard button on the Task Bar. The Chart Wizard should open, as shown in Figure 13.

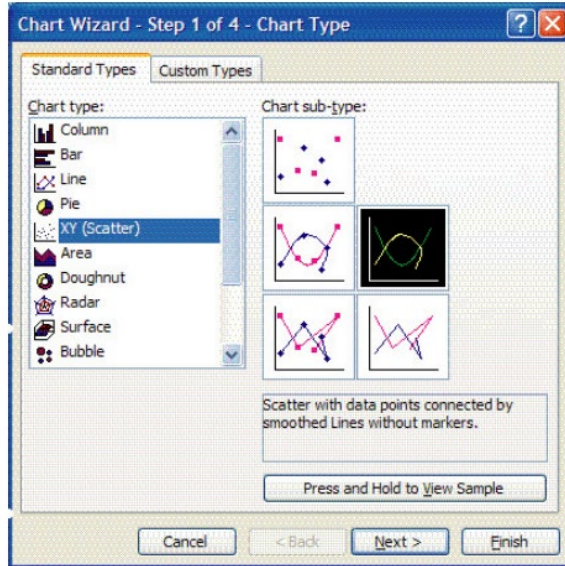


Figure 12. Chart Wizard – Step 1 window

- Choose the X-Y (Scatter) chart type and the Smoothed Lines Without Markers sub-type. Click Finish to display a graph of the spectrum, as shown in Figure 13.

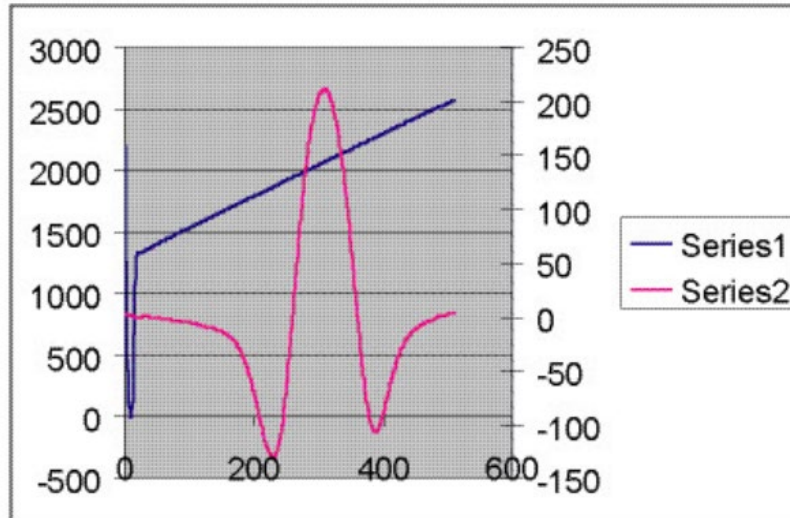


Figure 13. Data file plot in Excel

7. If the 2f curve appears flat, double click on it to get to the Format Data Series Window, as shown in Figure 15. Select the Axis tab, and select Plot Series on Secondary Axis. Click OK to rescale the plot.

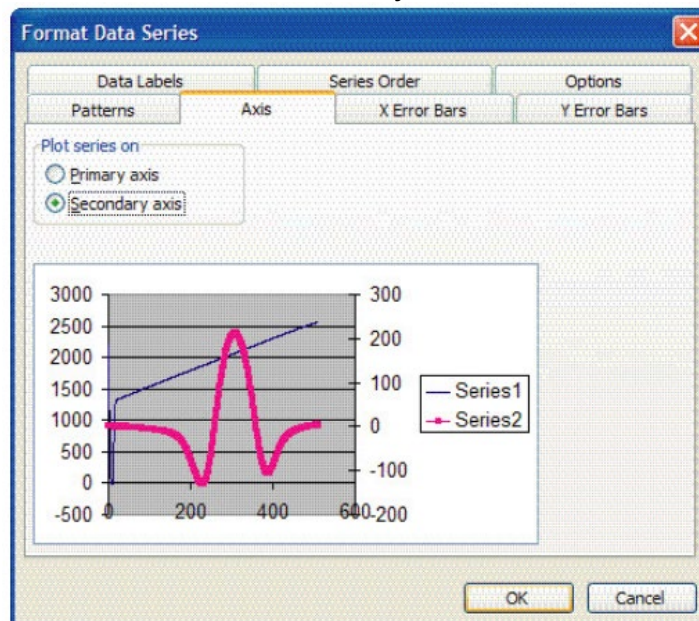


Figure 14. Format data series window

### 7.3 Modbus Communications Protocol

Modbus is a serial communications protocol published by Modicon in 1979 for use with its programmable logic controllers (PLCs). It has become a de facto standard communications protocol in industry, and is now the most commonly available means of connecting industrial electronic devices. Modbus is used extensively in lieu of other communications protocols because it is openly published and royalty-free, relatively easy to deploy, and capable of moving raw bits or words without placing many restrictions on vendors.

Modbus enables communication between many devices connected to the same network, for example, a supervisory computer with a remote terminal unit (RTU) in supervisory control and data acquisition (SCADA) systems.

The Endress+Hauser analyzer acts as a server in a client/server(s) network of devices. It can receive queries from a client and send responses back using either Gould Modbus RTU protocol or Daniel Extended Modbus RTU protocol.

#### 7.3.1 Framing/protocol

The transmission mode used to communicate is either Gould Modbus RTU or Daniel Modbus RTU with port parameters 9600 to 115200 (baud rate), 8 (data bits), 1 (stop bit), no (parity), and none (flow control/handshake).

The transmission mode is set by the user via the Modbus Mode parameter (see *To change parameters in Mode 2* → ).



*The generic serial output (HyperTerminal) is disabled if either Gould or Daniel Modbus is selected.*

### 7.3.2 Functions

Available functions are 0x03 (read holding registers), 0x06 (write to a single register), 0x10 (write to multiple registers), and 0x2B (read device identification).

### 7.3.3 Reading/writing in daniel modbus mode

Daniel Modbus supports three types of registers: short integer, long integer and floating point. Each “short integer” register is two bytes in length and will contain an integer value. Each “long integer” register is four bytes in length and will contain an integer value and each “floating point” register is four bytes in length and will contain a floating point value.

### 7.3.4 Reading/writing in gould modbus mode

Gould Modbus supports three types of variable data, short integer, long integer and floating point, but all registers are addressed as word (two byte) registers. A “short integer” value is contained in one register whereas a “long integer” or “floating point” value requires two contiguous registers. The registers are defined as Read or Read/Write.



*Use caution when writing to registers as changing the value of a writable register may affect the calibration of the analyzer.*

An appropriate password must be downloaded to the password register prior to writing to most registers. The User Level 1 (L1) user password 3142 will allow access to those registers which have been pre-defined as user configurable. Other writable registers can only be downloaded or changed by Endress+Hauser support personnel using a User Level 2 (L2) password.

### 7.3.5 Endianness

Endianness, often referred to as byte order, is the ordering of individually addressable sub-units (words, bytes, or even bits) within a longer data word. Byte orders with the most versus least significant byte first are called big-endian and little-endian, respectively. In Endress+Hauser analyzers, all bytes are stored big-endian. Thus, for floating point and long-integer data types, the byte order will look like:


|                   |                  |                  |                 |
|-------------------|------------------|------------------|-----------------|
| HighWord-HighByte | HighWord-LowByte | LowWord-HighByte | LowWord-LowByte |
|-------------------|------------------|------------------|-----------------|





The generic serial output (*HyperTerminal*) is disabled if either *gould* or *Daniel modbus* is selected.

### 7.3.6 To enable Modbus communications

1. Confirm that the serial cable has been properly connected.
2. Power up the analyzer (see *Powering up the analyzer* → )
3. Enter **Mode 2** by pressing the # key followed by the 2 key.

```
<SET PARAMETER MODE>
Enter password
NS 5.14-XXXX
```

The LCD prompts for a numeric password. Enter the user password (**3142**) on the keypad, then press the \* key to enter the number to enter **Mode 2** (Set Parameter Mode).

```
<SET PARAMETER MODE>
Process Purge Time
60
Enter a value(secs)
```

4. Press the \* key repeatedly until the **Modbus Address** parameter is displayed.

```
<SET PARAMETER MODE>
Modbus Address
1
Enter node (1-250)
```

5. Enter the desired **Modbus Address** and press the \* key to store the value and cycle to the **Modbus Mode** parameter.

```
<SET PARAMETER MODE>
Modbus Mode
0
0:Off 1:GMR 2:DMR
```

6. Enter the desired **Modbus Mode** and press the \* key to store the value and cycle to the **2 Way Com Port** parameter.
7. Enter the **2 Way Com Port** assignment and press the \* key to store the value.

```
<SET PARAMETER MODE>
2 Way Com Port
1
0:Off1:Cus2:Ser3:Eth
```

8. Press the # key followed by the 1 key to return to **Mode 1**. The analyzer is now ready to receive Modbus queries.

## 7.4 Addressing

The analyzer's Modbus slave node address can be in the range of 0-250 with a default of 1. All analyzers will respond to an address of 0, so this address can be used to interrogate a single unit when its address is unknown or to determine its address.

See the tables below for register definitions for both Gould and Daniel Modbus modes. Be aware that for Gould Modbus the table follows the convention of identifying the register with an offset of 40001. Therefore, the actual value transmitted in the starting register field of the command is the listed register value minus 40001, e.g., register 47001 is addressed as 7000.

| Parameter             | Daniel Reg. | Gould Reg. | Data Type | Action | Min. | Max. |
|-----------------------|-------------|------------|-----------|--------|------|------|
| Concentration Process | 7001        | 47001      | Float     | Read   | 0    | 0    |
| Temperature           | 7002        | 47003      | Float     | Read   | 0    | 0    |
| Pressure              | 7003        | 47005      | Float     | Read   | 0    | 0    |
| Concentration (ppmv)  | 7004        | 47007      | Float     | Read   | 0    | 0    |
| WetTemp (C)           | 7005        | 47009      | Float     | Read   | 0    | 0    |
| Wet Pressure (mb)     | 7006        | 47011      | Float     | Read   | 0    | 0    |
| FitResidue            | 7007        | 47013      | Float     | Read   | 0    | 0    |
| Current Midpoint      | 7008        | 47015      | Float     | Read   | 0    | 0    |
| Dew Point             | 7009        | 47017      | Float     | Read   | 0    | 0    |
| DC Level              | 7010        | 47019      | Float     | Read   | 0    | 0    |
| Zero Level            | 7011        | 47021      | Float     | Read   | 0    | 0    |
| 4-20 mA Output Value  | 7012        | 47023      | Float     | Read   | 0    | 0    |
| 4-20 mA Input Value   | 7013        | 47025      | Float     | Read   | 0    | 0    |
| RATA Mult Proposed    | 7014        | 47027      | Float     | Read   | 0    | 0    |
| RATA Offset Proposed  | 7015        | 47029      | Float     | Read   | 0    | 0    |
| Conc Process ppmv     | 7016        | 47031      | Float     | Read   | 0    | 0    |
| Concentration         | 7017        | 47033      | Float     | Read   | 0    | 0    |
| Val Date              | 7026        | 47051      | Float     | Read   | 0    | 0    |
| Val Time              | 7027        | 47053      | Float     | Read   | 0    | 0    |
| Val 1 Value           | 7028        | 47055      | Float     | Read   | 0    | 0    |
| Val 2 Value           | 7029        | 47057      | Float     | Read   | 0    | 0    |
| Val 1 Value ppmv      | 7030        | 47059      | Float     | Read   | 0    | 0    |

|                      |      |       |       |                     |           |          |
|----------------------|------|-------|-------|---------------------|-----------|----------|
| Val 2 Value ppmv     | 7031 | 47061 | Float | Read                | 0         | 0        |
| Val 1 Avg Value      | 7032 | 47063 | Float | Read                | 0         | 0        |
| Val 1 Avg Value ppmv | 7033 | 47065 | Float | Read                | 0         | 0        |
| Val 1 Min Value ppmv | 7034 | 47067 | Float | Read                | 0         | 0        |
| Val 1 Max Value ppmv | 7035 | 47069 | Float | Read                | 0         | 0        |
| Val 2 Avg Value      | 7036 | 47071 | Float | Read                | 0         | 0        |
| Val 2 Avg Value ppmv | 7037 | 47073 | Float | Read                | 0         | 0        |
| Val 2 Min Value ppmv | 7038 | 47075 | Float | Read                | 0         | 0        |
| Val 2 Max Value ppmv | 7039 | 47077 | Float | Read                | 0         | 0        |
| Dry Temp (C)         | 7041 | 47081 | Float | Read                | 0         | 0        |
| Dry Pressure (mb)    | 7042 | 47083 | Float | Read                | 0         | 0        |
| Dry DC Level         | 7043 | 47085 | Float | Read                | 0         | 0        |
| Common Weight        | 7051 | 47101 | Float | Read                | 0         | 0        |
| Fitting Ratio        | 7052 | 47103 | Float | Read                | 0         | 0        |
| Fitting Ratio 2      | 7053 | 47105 | Float | Read                | 0         | 0        |
| Fitting Ratio 3      | 7054 | 47107 | Float | Read                | 0         | 0        |
| Fitting Ratio 4      | 7055 | 47109 | Float | Read                | 0         | 0        |
| Fitting Ratio 5      | 7056 | 47111 | Float | Read                | 0         | 0        |
| Fitting Ratio Dry    | 7057 | 47113 | Float | Read                | 0         | 0        |
| Fitting Ratio Dry-1  | 7058 | 47115 | Float | Read                | 0         | 0        |
| Cross Shift          | 7060 | 47119 | Float | Read                | 0         | 0        |
| Peak Track Index     | 7061 | 47121 | Float | Read                | 0         | 0        |
| Peak Index Ref       | 7062 | 47123 | Float | Read                | 0         | 0        |
| Peak Track Index Dry | 7091 | 47181 | Float | Read                | 0         | 0        |
| Peak Index Ref Dry   | 7092 | 47183 | Float | Read                | 0         | 0        |
| RATA Multiplier      | 7101 | 47201 | Float | R/W L1 <sup>1</sup> | -10000000 | 10000000 |
| RATA Offset          | 7102 | 47203 | Float | R/W L1 <sup>1</sup> | -10000000 | 10000000 |

|                      |      |       |       |                     |           |          |
|----------------------|------|-------|-------|---------------------|-----------|----------|
| Low Alarm Setpoint   | 7103 | 47205 | Float | R/W L1 <sup>1</sup> | -10000000 | 10000000 |
| High Alarm Setpoint  | 7104 | 47207 | Float | R/W L1 <sup>1</sup> | -10000000 | 10000000 |
| AO 4 mA Value        | 7105 | 47209 | Float | R/W L1 <sup>1</sup> | 0         | 10000000 |
| AO 20 mA Value       | 7106 | 47211 | Float | R/W L1 <sup>1</sup> | 0         | 10000000 |
| AO 4-20 mA Test      | 7107 | 47213 | Float | R/W L1 <sup>1</sup> | 0         | 100      |
| AI 4 mA Value        | 7108 | 47215 | Float | R/W L1 <sup>1</sup> | 0         | 10000000 |
| AI 20 mA Value       | 7109 | 47217 | Float | R/W L1 <sup>1</sup> | 0         | 10000000 |
| Val 1 Concentration  | 7110 | 47219 | Float | R/W L1 <sup>1</sup> | 0         | 10000000 |
| Val 2 Concentration  | 7111 | 47221 | Float | R/W L1 <sup>1</sup> | 0         | 10000000 |
| Validation Allowance | 7112 | 47223 | Float | R/W L1 <sup>1</sup> | 0         | 100      |
| Zero Val Tolerance   | 7113 | 47225 | Float | R/W L1 <sup>1</sup> | 0         | 10000000 |
| Pipeline Pressure    | 7125 | 47249 | Float | R/W L1 <sup>1</sup> | 0         | 50000000 |
| Methane              | 7126 | 47251 | Float | R/W L1 <sup>1</sup> | 0         | 1        |
| Ethane               | 7127 | 47253 | Float | R/W L1 <sup>1</sup> | 0         | 1        |
| Nitrogen             | 7128 | 47255 | Float | R/W L1 <sup>1</sup> | 0         | 1        |
| Carbon Dioxide       | 7129 | 47257 | Float | R/W L1 <sup>1</sup> | 0         | 1        |
| Propane              | 7130 | 47259 | Float | R/W L1 <sup>1</sup> | 0         | 1        |
| AO 4-20 mA Test      | 7107 | 47213 | Float | R/W L1 <sup>1</sup> | 0         | 1        |
| I-Butane             | 7131 | 47261 | Float | R/W L1 <sup>1</sup> | 0         | 1        |
| N-Butane             | 7132 | 47263 | Float | R/W L1 <sup>1</sup> | 0         | 1        |
| Neo-Pentane          | 7133 | 47265 | Float | R/W L1 <sup>1</sup> | 0         | 1        |
| I-Pentane            | 7134 | 47267 | Float | R/W L1 <sup>1</sup> | 0         | 1        |
| N-Pentane            | 7135 | 47269 | Float | R/W L1 <sup>1</sup> | 0         | 1        |
| Hexane               | 7136 | 47271 | Float | R/W L1 <sup>1</sup> | 0         | 1        |
| ppmv ConvFactor 00   | 7139 | 47277 | Float | R/W L1 <sup>1</sup> | 0         | 10000000 |
| lb ConvFactor 01     | 7140 | 47279 | Float | R/W L1 <sup>1</sup> | 0         | 10000000 |
| % ConvFactor 02      | 7141 | 47281 | Float | R/W L1 <sup>1</sup> | 0         | 10000000 |
| mg/s ConvFactor 03   | 7142 | 47283 | Float | R/W L1 <sup>1</sup> | 0         | 10000000 |


|                         |      |       |         |                     |   |          |
|-------------------------|------|-------|---------|---------------------|---|----------|
| ppmw<br>ConvFactor 04   | 7143 | 47285 | Float   | R/W L1 <sup>1</sup> | 0 | 10000000 |
| ppbv<br>ConvFactor 05   | 7144 | 47287 | Float   | R/W L1 <sup>1</sup> | 0 | 10000000 |
| I-Butane                | 7131 | 47261 | Float   | R/W L1 <sup>1</sup> | 0 | 10000000 |
| ppbw<br>ConvFactor 06   | 7145 | 47289 | Float   | R/W L1 <sup>1</sup> | 0 | 10000000 |
| grn ConvFactor<br>07    | 7146 | 47291 | Float   | R/W L1 <sup>1</sup> | 0 | 10000000 |
| user<br>ConvFactor 08   | 7147 | 47293 | Float   | R/W L1 <sup>1</sup> | 0 | 10000000 |
| Val Perm Const<br>Kp    | 7212 | 47423 | Float   | R/W L1 <sup>1</sup> | 0 | 10000000 |
| Val Perm Rate<br>Rp     | 7213 | 47425 | Float   | R/W L1 <sup>1</sup> | 0 | 10000000 |
| Alarm Flags             | 5001 | 45001 | Long    | Read                | 0 | 0        |
| Status Flags            | 5002 | 45003 | Long    | Read                | 0 | 0        |
| DO Alarm<br>Setup       | 5101 | 45201 | Long    | R/W L1 <sup>1</sup> | 0 | 4.29E+09 |
| user EU Tag<br>Part 1   | 5102 | 45203 | Long    | R/W L1 <sup>1</sup> | 0 | 4.29E+09 |
| user EU Tag<br>Part 2   | 5103 | 45205 | Long    | R/W L1 <sup>1</sup> | 0 | 4.29E+09 |
| Current 2F<br>Flag      | 3103 | 43103 | Integer | Read                | 0 | 0        |
| Logger Rate             | 3202 | 43202 | Integer | R/W L1 <sup>1</sup> | 1 | 1000     |
| 4-20 mA<br>Alarm Action | 3204 | 43204 | Integer | R/W L1 <sup>1</sup> | 0 | 3        |
| Temperature<br>Unit     | 3205 | 43205 | Integer | R/W L1 <sup>1</sup> | 0 | 1        |
| Pressure Unit           | 3206 | 43206 | Integer | R/W L1 <sup>1</sup> | 0 | 3        |
| Concentration<br>Unit   | 3207 | 43207 | Integer | R/W L1 <sup>1</sup> | 0 | 8        |
| Modbus<br>Address       | 3208 | 43208 | Integer | R/W L1 <sup>1</sup> | 0 | 250      |
| Modbus Mode             | 3209 | 43209 | Integer | R/W L1 <sup>1</sup> | 0 | 2        |
| AI Pressure<br>Input    | 3210 | 43210 | Integer | R/W L1 <sup>1</sup> | 0 | 1        |
| RATA                    | 3211 | 43211 | Integer | R/W L1 <sup>1</sup> | 0 | 1        |
| New Scrub<br>Installed  | 3212 | 43212 | Integer | R/W L1 <sup>1</sup> | 0 | 1        |
| General Alarm<br>DO     | 3213 | 43213 | Integer | R/W L1 <sup>1</sup> | 0 | 2        |
| Baud Rate               | 3214 | 43214 | Integer | R/W L1 <sup>1</sup> | 0 | 4        |

|                       |      |       |         |                     |      |       |
|-----------------------|------|-------|---------|---------------------|------|-------|
| Set Time - Year       | 3215 | 43215 | Integer | R/W L1 <sup>1</sup> | 2007 | 2143  |
| Set Time - Month      | 3216 | 43216 | Integer | R/W L1 <sup>1</sup> | 1    | 12    |
| Set Time - Day        | 3217 | 43217 | Integer | R/W L1 <sup>1</sup> | 1    | 31    |
| Set Time - Hour       | 3218 | 43218 | Integer | R/W L1 <sup>1</sup> | 0    | 23    |
| Set Time - Minute     | 3219 | 43219 | Integer | R/W L1 <sup>1</sup> | 0    | 59    |
| Cancel Val Alarms     | 3220 | 43220 | Integer | R/W L1 <sup>1</sup> | 0    | 1     |
| Daily Validation      | 3221 | 43221 | Integer | R/W L1 <sup>1</sup> | 0    | 1     |
| Val Start Time        | 3222 | 43222 | Integer | R/W L1 <sup>1</sup> | 0    | 23    |
| Val Interval          | 3223 | 43223 | Integer | R/W L1 <sup>1</sup> | 1    | 400   |
| Start Validation      | 3224 | 43224 | Integer | R/W L1 <sup>1</sup> | 0    | 1     |
| Val Purge Period      | 3225 | 43225 | Integer | R/W L1 <sup>1</sup> | 0    | 4000  |
| Val Duration          | 3226 | 43226 | Integer | R/W L1 <sup>1</sup> | 0    | 8000  |
| Val Attempts          | 3227 | 43227 | Integer | R/W L1 <sup>1</sup> | 1    | 8000  |
| 4-20 mA Val Action    | 3228 | 43228 | Integer | R/W L1 <sup>1</sup> | 0    | 1     |
| Val Auto DumpSpectrum | 3230 | 43230 | Integer | R/W L1 <sup>1</sup> | 0    | 1     |
| Update RATA           | 3231 | 43231 | Integer | R/W L1 <sup>1</sup> | 0    | 1     |
| Conversion Type       | 3251 | 43251 | Integer | R/W L1 <sup>1</sup> | 0    | 1     |
| Calculate Dew Point   | 3252 | 43252 | Integer | R/W L1 <sup>1</sup> | 0    | 2     |
| Dew Point Method      | 3253 | 43253 | Integer | R/W L1 <sup>1</sup> | 0    | 3     |
| Validation Wait Time  | 3311 | 43311 | Integer | R/W L1 <sup>1</sup> | 60   | 32000 |
| 2 Way Com Port        | 3365 | 43365 | Integer | R/W L1 <sup>1</sup> | 0    | 3     |
| Keypad Watchdog       | 3368 | 43368 | Integer | R/W L1 <sup>1</sup> | 0    | 9999  |
| Custom Precision      | 3413 | 43413 | Integer | R/W L1 <sup>1</sup> | 0    | 5     |
| Peak Tracking         | 3419 | 43419 | Integer | R/W L1 <sup>1</sup> | 0    | 2     |
| Operator Password     | 3501 | 43501 | Integer | R/W L1 <sup>1</sup> | 0    | 9999  |
| Operator Parameter01  | 3502 | 43502 | Integer | R/W L1 <sup>1</sup> | 0    | 252   |

|                      |      |       |         |                     |   |      |
|----------------------|------|-------|---------|---------------------|---|------|
| Operator Parameter02 | 3503 | 43503 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter03 | 3504 | 43504 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter04 | 3505 | 43505 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter05 | 3506 | 43506 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter06 | 3507 | 43507 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter07 | 3508 | 43508 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter08 | 3509 | 43509 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter09 | 3510 | 43510 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter10 | 3511 | 43511 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter11 | 3512 | 43512 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter12 | 3513 | 43513 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter13 | 3514 | 43514 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter14 | 3515 | 43515 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter15 | 3516 | 43516 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter16 | 3517 | 43517 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter17 | 3518 | 43518 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter18 | 3519 | 43519 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter19 | 3520 | 43520 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Operator Parameter20 | 3521 | 43521 | Integer | R/W L1 <sup>1</sup> | 0 | 252  |
| Password             | 4999 | 44999 | Integer | R/W L0              | 0 | 9999 |

<sup>1</sup>Write privilege requires User Level 1 (L1) password to be downloaded to the Password register.

#### 7.4.1.1 Modbus accessible parameter definitions

For definitions of the Modbus accessible parameters shown in Modbus register map, see below. For more detailed information, refer to *Measurement and control parameters defined* → .

- **% ConvFactor 02:** Sets a custom conversion factor when the parameter Concentration Unit = 2 (%) and this value is greater than 0.0. When it is equal to 0.0, the default conversion factor is used.
- **2 Way Com Port:** Sets the port that allows two-way communications, including Modbus and the diagnostic protocol.

- **4-20 mA Alarm Action:** Determines the current loop state upon an alarm condition.
- **4-20 mA Input Value:** The current value of the 4-20 mA input for pipeline pressure in mA's.
- **4-20 mA Output Value:** The current value of the 4-20 mA output for concentration in mA's.
- **4-20 mA Val Action:** Sets the operation mode of the 4-20 mA current loop during validation cycles.
- **Alarm Flags:** Bitwise value identifying the status of each individual alarm in the analyzer, as shown in the Table.

| Bit | Hex Value | Functionality                            |
|-----|-----------|--|
| 0   | 0000001   | Any alarm active or happened in the past |
| 1   | 0000002   | Any alarm active (general fault)         |
| 2   | 0000004   | Laser power is too low                   |
| 3   | 0000008   | Laser power is too high                  |
| 4   | 0000010   | Laser zero is too low                    |
| 5   | 0000020   | Laser zero is too high                   |
| 6   | 0000040   | Laser current is too low                 |
| 7   | 0000080   | Laser current is too high                |
| 8   | 0000100   | Pressure is too low                      |
| 9   | 0000200   | Pressure is too high                     |
| 10  | 0000400   | Temperature is too low                   |
| 11  | 0000800   | Temperature is too high                  |
| 12  | 0001000   | Concentration is too low                 |
| 13  | 0002000   | Concentration is too high                |
| 14  | 0004000   | Peak tracking restart exceeds limit      |
| 15  | 0008000   | Fitting restart exceeds limit            |
| 16  | 0010000   | Ramp adjust restart exceeds limit        |
| 17  | 0020000   | Not used                                 |
| 18  | 0040000   | Not used                                 |
| 19  | 0080000   | Flow switch alarm                        |
| 20  | 0100000   | Validation fail alarm 1                  |
| 21  | 0200000   | Validation fail alarm 2                  |
| 22  | 0400000   | Not used                                 |
| 23  | 0800000   | Not used                                 |

- **AI 20 mA Value:** Sets the pipeline pressure (in mbar) corresponding to a 20 mA current loop input.
- **AI 4 mA Value:** Sets the pipeline pressure (in mbar) corresponding to a 4 mA current loop input.
- **AI Pressure Input:** Enables or disables the analog input pipeline pressure capability.
- **AO 20 mA Value:** Sets the concentration (in ppmv) or dew point temperature (in degrees Celsius or Fahrenheit), depending on whether dew point temperature calculation and display is enabled (i.e., the **Calculate Dew Point** parameter set equal to 1), corresponding to a 4 mA current loop output.
- **AO 4 mA Value:** Sets the concentration (in ppmv) or dew point temperature (in degrees Celsius or Fahrenheit) corresponding to a 4 mA current loop output.
- **AO 4-20 mA Test:** Sets the output of the current loop when in Mode 5. The value entered represents a percent of scale value where zero equals 4 mA and full scale equals 20 mA.
- **Baud Rate:** Sets the baud rate for the customer serial port.
- **Calculate Dew Point:** Enables the calculation of the dew point value and controls where the value will be output.



- **Cancel Val Alarms:** Cancels all validation alarms and flags that are activated.
- **Carbon Dioxide:** Sets the mole fraction of carbon dioxide in the dry gas mixture that is used when calculating the dew point temperature per ISO 18453:2006. The default value (0.00000) corresponds to the natural gas mixture NG3 of the Table.
- **Common Weight:** Ratio of the measured spectrum that did not match a reference spectrum.
- **Concentration:** Current measured (live) analyte concentration (process or validation) in selected engineering units.
- **Concentration (ppmv)** Current measured (live) analyte concentration (process or validation) in parts per million by volume (ppmv).
- **Concentration Process:** Measured analyte concentration (process or validation) of last process reading in selected engineering units.
- **Concentration Unit:** Designates the display units for the measured concentration.
- **Conc Process ppmv:** Measured analyte concentration of last process reading in parts per million by volume (ppmv).
- **Conversion Type:** Sets the type of relations (ideal or real gas) used in the dew point calculation [0 for ideal gas relations or 1 for real gas relations (Z calculated using Peng-Robinson EOS)].
- **Cross Shift:** The amount of shift applied to match the measured spectrum to the reference spectrum when using Cross Correlation.
- **Current 2F Flag:** Displays the current scrubber protection usage level: 0 = standard protection (used for non-differential units), 1 = mid protection, 2 = high protection, 3 = maximum protection (no usage).
- **Current Midpoint:** Current midpoint that the analyzer is using, including any peak tracking adjustments.
- **Custom Precision:** Sets the number of viewable digits to the right of the decimal point.
- **Daily Validation:** Enables or disables the time of day autovalidation feature.
- **DC Level:** Signal level at the high end of the current ramp.
- **Dew Point:** Measured analyte concentration of last process reading as a moisture dew point.
- **Dew Point Method:** Sets the industry standard method with which the dew point temperature is determined when Calculate Dew Point is enabled.
- **DO Alarm Setup:** Bitwise value that sets the functionality of the Assignable Alarm, as listed in the table.
- **Dry DC Level:** Signal level at the high end of the DC current ramp from the last scrubber cycle.
- **Dry Pressure (mb):** Measured pressure (0.0 for non-differential units) of the gas sample from the last scrubber cycle in millibar (mb).
- **Dry Temp (C):** Measured temperature (0.0 for non-differential units) of the gas sample from the last scrubber cycle in degrees Celsius.
- **Ethane:** Sets the mole fraction of ethane in the dry gas mixture used when calculating the dew point temperature per ISO 18453:2006. The default value (0.08360) corresponds to the natural gas mixture NG3.
- **FitResidue:** Value ranging from 0 to 1 indicating how well the measured spectrum fits the referenced spectrum, where 1 represents a perfect match.
- **Fitting Ratio:** Ratio of the measured spectrum versus the Reference 1 or Validation spectrum.
- **Fitting Ratio 2:** Ratio of the measured spectrum versus the Reference 2 spectrum, where a value of 0 indicates that the Reference 2 spectrum was not used in the calculation of concentration.
- **Fitting Ratio 3:** Ratio of the measured spectrum versus the Reference 3 spectrum, where a value of 0 indicates that the Reference 3 spectrum was not used in the calculation of concentration.
- **Fitting Ratio 4:** Ratio of the measured spectrum versus the Reference 4 spectrum, where a value of 0 indicates that the Reference 4 spectrum was not used in the calculation of concentration.
- **Fitting Ratio 5:** Ratio of the measured spectrum versus the Reference 5 spectrum, where a value of 0 indicates that the Reference 5 spectrum was not used in the calculation of concentration.
- **Fitting Ratio Dry:** Ratio of the measured spectrum versus the Reference Dry spectrum, where a value of 0 indicates that the Reference Dry spectrum was not used in the calculation of concentration.
- **Fitting Ratio Dry-1:** Ratio of the measured spectrum versus the Reference Dry spectrum shifted by 1 index value, where a value of 0 indicates that the Reference Dry spectrum shifted by 1 index value was not used in the calculation of concentration.
- **General Alarm DO:** Sets the operation of the general alarm relay digital output when a general fault alarm occurs and allows it to be reset if needed.
- **grn ConvFactor 07:** Sets a custom conversion factor when the parameter Concentration Unit = 7 (grains/100 scf) and this value is greater than 0.0. The default value conversion factor is used when it is equal to 0.0.

- **Hexane:** Sets the mole fraction of hexane in the dry gas mixture used when calculating the dew point temperature per ISO 18453:2006. The default value (0.00000) corresponds to the natural gas mixture NG3 of the Table.
- **High Alarm Setpoint:** Determines the concentration threshold (ppmv or dew point C/F) above which the **Concentra High Alarm** will be triggered (see *Alarms* → ⓘ)
- **I-Butane:** Sets the mole fraction of i-butane in the dry gas mixture used when calculating the dew point temperature per ISO 18453:2006. The default value (0.00293) corresponds to the natural gas mixture NG3.
- **I-Pentane:** Sets the mole fraction of i-pentane in the dry gas mixture used when calculating the dew point temperature per ISO 18453:2006. The default value (0.00020) corresponds to the natural gas mixture NG3.
- **Keypad Watchdog:** Sets the allowable time (in seconds) that the analyzer can be on the MODE screen and the Mode 2 (Set Parameter Mode) password screen before automatically reverting to Mode 1 (Normal Mode).
- **Ib ConvFactor 01:** Sets a custom conversion factor when the parameter Concentration Unit = 1 (lbs/MMscf) and this value is greater than 0.0. The default conversion factor is used when it is equal to 0.0.
- **Logger Rate:** Sets the number of measurements included in the running average.
- **Low Alarm Setpoint:** Determines the concentration threshold (ppmv or dew point C/F) below which the **Concentra Low Alarm** will be triggered. (See *Alarms* → ⓘ).
- **Methane:** Sets the mole fraction of methane in the dry gas mixture used when calculating the dew point temperature per ISO 18453:2006. The default value (0.88204) corresponds to the natural gas mixture NG3.
- **mg ConvFactor 03:** Sets a custom conversion factor when the parameter Concentration Unit = 3 (mg/nm3) and this value is greater than 0.0. The default conversion factor is used when it is equal to 0.0.
- **Modbus Address:** Sets the analyzer address when the analyzer is used as a Modbus slave device.
- **Modbus Mode:** Sets the communications protocol for the port selected by the **2 Way Com Port** parameter.
- **N-Butane:** Sets the mole fraction of n-butane in the dry gas mixture used when calculating the dew point temperature per ISO 18453:2006. The default value (0.00441) corresponds to the natural gas mixture NG3.
- **N-Pentane:** Sets the mole fraction of n-pentane in the dry gas mixture used when calculating the dew point temperature per ISO 18453:2006. The default value (0.00004) corresponds to the natural gas mixture NG3.
- **Neo-Pentane:** Sets the mole fraction of neo-pentane in the dry gas mixture used when calculating the dew point temperature per ISO 18453:2006. The default value (0.00003) corresponds to the natural gas mixture NG3.
- **Nitrogen:** Sets the mole fraction of nitrogen in the dry gas mixture used when calculating the dew point temperature per ISO 18453:2006. The default value (0.00912) corresponds to the natural gas mixture NG3.
- **Operator Parameter01 to Operator Parameter20:** Parameter indices for parameters to be viewed through the Operator Parameter section.
- **Operator Password:** Sets a password for the Operator Parameter section.
- **Password:** Required to access the system to download (i.e., change) register settings. In the table, those registers denoted as R/W L1 can be modified if the User Level 1 password is downloaded to this register.
- **Peak Index Ref:** Peak index used for reference.
- **Peak Index Ref Dry:** Peak index (0.0 for non-differential units) used for reference from the last scrubber cycle.
- **Peak Track Index:** Peak index of the measured spectrum.
- **Peak Track Index Dry:** Peak index (0.0 for non-differential units) of the measured spectrum from the last scrubber cycle.
- **Peak Tracking:** A software utility that periodically adjusts the laser current to keep the absorption peak of the measured component at a known location.
- **Pipeline Pressure:** Sets the pipeline pressure (in mbar) in the current dew point calculation or, if enabled, displays the current pipeline pressure input through the AI Pressure Input.
- **ppbv ConvFactor 05:** Sets a custom conversion factor when the parameter Concentration Unit = 5 (ppbv) and this value is greater than 0.0. When it is equal to 0.0, the default conversion factor is used.
- **ppbw ConvFactor 06:** Sets a custom conversion factor when the parameter Concentration Unit = 6 (ppbw) and this value is greater than 0.0. When it is equal to 0.0, the default conversion factor is used.
- **ppmv ConvFactor 00:** Sets a custom conversion factor when the parameter Concentration Unit = 0 (ppmv) and this value is greater than 0.0. The default conversion factor is used when it is equal to 0.0.
- **ppmw ConvFactor 04:** Sets a custom conversion factor when the parameter Concentration Unit = 4 (ppmw) and this value is greater than 0.0. The default conversion factor is used when it is equal to 0.0.
- **Pressure:** Current measured (live) wet pressure reading of the gas sample in selected engineering units.
- **Pressure Unit:** Designates the display units for the measured absolute pressure in the cell.

- **Propane:** Sets the mole fraction of propane in the dry gas mixture used when calculating the dew point temperature per ISO 18453:2006. The default value (0.01763) corresponds to the natural gas mixture NG3.
- **RATA:** Enables or disables user definable values that allow adjustment (without affecting the factory calibration) of the analyzer reading in the field. Refer to **Adjust Analyzer Reading to Match Specific Standard(s)**.
- **RATA Multiplier:** User definable value that enables adjustment (without affecting the factory calibration) of the analyzer response (or slope) in the field. Refer to **Adjust Analyzer Reading to Match Specific Standard(s)**.
- **RATA Multiplier Proposed:** The latest proposed RATA multiplier value calculated based on the last validation run.
- **RATA Offset:** User definable value that enables adjustment (without affecting the factory calibration) of the analyzer offset in the field. Refer to **Adjust Analyzer Reading to Match Specific Standard(s)**.
- **RATA Offset Proposed:** The latest proposed RATA offset value calculated based on the last validation run.
- **Set time - year:** Sets the current year for the real time clock.
- **Set time - month:** Sets the current month for the real time clock.
- **Set time - day:** Sets the current day for the real time clock.
- **Set time - minute:** Sets the current minute for the real time clock.
- **Set time - hour:** Sets the current hour for the real time clock.
- **Start validation:** Initiates a validation cycle.
- **Status flags:** Long Bitwise value identifying the occurrence of various events in the analyzer, as listed in the Table.

| Bit | Hex Value | Functionality                     |
|-----|-----------|-----------------------------------|
| 16  | 0010000   | Ramp adjust restart exceeds limit |
| 17  | 0020000   | Not used                          |
| 18  | 0040000   | Not used                          |
| 19  | 0080000   | Flow switch alarm                 |
| 20  | 0100000   | Validation fail alarm 1           |
| 21  | 0200000   | Validation fail alarm 2           |
| 22  | 0400000   | Not used                          |
| 23  | 0800000   | Not used                          |

- **Temperature:** Current measured (live) wet temperature of the gas sample in selected engineering units.
- **Temperature Unit:** Designates the display units for the measured cell temperature and for dew point calculations.
- **Update RATA:** When set to **1**, stores the latest proposed RATA multiplier and offset values in the RATA Multiplier and RATA Offset parameters, respectively.
- **user ConvFactor 08:** Sets a custom conversion factor when the parameter Concentration Unit = 8 (user EU Tag Part 1 and 2) and this value is greater than 0.0. The default conversion factor is used when it is equal to 0.0.
- **user EU Tag Part 1:** Sets a custom engineering unit tag name for the beginning four ASCII characters. For example: A is ASCII hex value 41, so AAAA would be 41414141, which would be 1,094,795,585 in decimal format. Refer to the Table.
- **user EU Tag Part 2:** Sets a custom engineering unit tag name for the last four ASCII characters. For example: A is ASCII hex value 41, so AAAA would be 41414141, which would be 1,094,795,585 in decimal format. Refer to the Table.

To find the hexadecimal value in the Table, first locate the character needed in the table and trace to the reference number in the row (c) at the top of the table, then use the row to the left (r) to create the value (cr). For example, locate the 'A' in the table. The 'A' corresponds with the value (4) in the row at the top of the table. Next, follow the row in which 'A' is present to the value at the left of the table (1). Combined, these create the hexadecimal value of 41.

|  |   | Higher 4-bit (D4 to D7) of Character Code (Hexadecimal) |   |    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|--|---|---|---|----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |   | 0   | 1 | 2  | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |   |
| Lower 4-bit (D0 to D3) of Character Code (Hexadecimal) | 0 | CG RAM (0)  | + | 0  | P | ' | F | S | E | A | " | I | M | P | C |   |   |   |
|  | 1 | CG RAM (1)  | . | 1  | A | a | q | u | a | i | " | J | T | Y | U |   |   |   |
|  | 2 | CG RAM (2)  | " | Z  | E | R | b | r | e | E | S | ' | w | S | O | X |   |   |
|  | 3 | CG RAM (3)  | # | 3  | O | S | c | s | a | o | " | I | T | e | v |   |   |   |
|  | 4 | CG RAM (4)  | / | \$ | 4 | D | T | d | t | a | s | t | ' | e | r | z | o |   |
|  | 5 | CG RAM (5)  | 7 | 5  | E | U | e | u | a | b | s | E | f | a | t | a | n | T |
|  | 6 | CG RAM (6)  | @ | 6  | F | U | f | u | a | o | # | U | W | B | B | F |   |   |
|  | 7 | CG RAM (7)  | " | 7  | S | U | s | u | G | R | X | + | A | L | H |   |   |   |
|  | 8 | CG RAM (8)  | < | C  | H | K | h | k | e | y | + | + | E | K | M |   |   |   |
|  | 9 | CG RAM (9)  | > | 9  | I | Y | i | y | e | D | I | K | N | T | X | K |   |   |
|  | A | CG RAM (A)  | * | #  | J | Z | j | z | e | O | A | z | T | Z | U | F |   |   |
|  | B | CG RAM (B)  | + | #  | K | K | C | I | n | a | s | @ | L | N | V | A |   |   |
|  | C | CG RAM (C)  | . | <  | L | \ | I | I | n | S | @ | J | Q | Z | O |   |   |   |
|  | D | CG RAM (D)  | ~ | -  | M | I | n | ) | i | e | z | # | . | U | π | - |   |   |
|  | E | CG RAM (E)  | # | .  | > | N | n | ^ | a | b | e | f | o | r | p | S |   |   |
|  | F | CG RAM (F)  | ~ | /  | ? | 0 | _ | o | Δ | Δ | z | z | ' | 0 | o | o | Δ |   |

Figure 15 ASCII character map

If using the AMS100 software to update these values, the characters desired can be typed directly from the PC keyboard. However, only the keys on the PC keyboard are supported. For instance, superscript values for engineering units, such as mg/m<sup>3</sup> are not supported. To use a superscript value (superscript<sup>3</sup> equates to hex 1F from the Table) Modbus must be used to download the desired characters.

- **Val 1 Concentration:** Sets the concentration value of validation gas supply #1.
- **Val 2 Concentration:** Sets the concentration value of validation gas supply #2.
- **Val 1 Value:** Measured concentration (in selected engineering units) of validation gas 1.
- **Val 2 Value:** Measured concentration (in selected engineering units) of validation gas 2.
- **Val 1 Avg Value:** Average analyte concentration of last validation 1 measurement period in selected engineering units.
- **Val 2 Avg Value:** Average analyte concentration of last validation 2 measurement period in selected engineering units.
- **Val 1 Avg Value ppmv:** Average analyte concentration of last validation 1 measurement period in parts per million by volume (ppmv).
- **Val 2 Avg Value ppmv:** Average analyte concentration of last validation 2 measurement period in parts per million by volume (ppmv).
- **Val 1 Min Value ppmv:** Minimum analyte concentration of last validation 1 measurement period in parts per million by volume (ppmv).
- **Val 2 Min Value ppmv:** Minimum analyte concentration of last validation 2 measurement period in parts per million by volume (ppmv).
- **Val 1 Max Value ppmv:** Maximum analyte concentration of last validation 1 measurement period in parts per million by volume (ppmv).
- **Val 2 Max Value ppmv:** Maximum analyte concentration of last validation 2 measurement period in parts per million by volume (ppmv).
- **Val 1 Value ppmv:** Measured analyte concentration of last validation 1 reading in parts per million by volume (ppmv).
- **Val 2 Value ppmv:** Measured analyte concentration of last validation 2 reading in parts per million by volume (ppmv).
- **Val Attempts:** In differential systems, this sets the maximum number of validation failures before stopping the autovalidation sequence and triggering a validation fail alarm. In non-differential systems, this sets the number of validation attempts when using autovalidation. It also sets the number of validation attempts in perm tube validation mode.

- **Val Auto DumpSpectrm:** Determines whether a **Mode 6** dump automatically occurs after each validation measurement.
- **Val Date:** Date of the last validation.
- **Val Duration:** Sets the total number of seconds a validation cycle will run in differential systems. In non-differential systems, this sets the total time for each validation sequence in perm tube validation mode.
- **Val Interval:** Sets the number of days between autovalidation cycles.
- **Validation Allowance:** Sets the tolerance ( $\pm\%$ ) for validation measurements when Val 1 Concentration or Val 2 Concentration is set to a value greater than 0.
- **Validation Wait Time:** Sets the amount of time (in seconds) for the validation gas to purge the system at the beginning of the validation.
- **Val Perm Constant Kp:** Sets the system constant for the perm tube.
- **Val Perm Rate Rp:** Sets the calibrated permeation rate for the perm tube.
- **Val Purge Period:** Sets the number of seconds upon validation initiation that a differential analyzer will purge the system with validation gas before starting a dry cycle.
- **Val Start Time:** Sets the hour of the day for the daily autovalidation to begin.
- **Val Time:** Time of last validation.
- **Wet Pressure (mb):** Current measured (live) wet pressure reading of the gas sample in millibar (mb).
- **Wet Temp (C):** Current measured (live) temperature of the gas sample in degrees Celsius.
- **Zero Val Tolerance:** Sets the maximum acceptable reading (in ppmv) when validating with zero gas (Val 1 Concentration = 0 or Val 2 Concentration = 0).
- **Zero Level:** Signal level when the laser is turned off.

## 8 Ethernet communications

### 8.1 Configuring the built-in Ethernet port

The built-in Ethernet port must be properly configured to communicate on a network or directly with a PC. The Ethernet port has been factory set as follows:

- **IP Address:** 192.168.000.001
- **Telnet (Set-up) Port:** 9999
- **Web Manager (Set-up) port:** 30718 (Fixed)
- **Serial Data Port:** 10001

The configuration is stored in nonvolatile memory and is retained without power. The configuration can be changed at any time.

If the IP address or any other setting needs to be changed, the Ethernet port **Setup Mode** can be accessed using a Telnet connection, the Web Manager locally or over the network.

### 8.2 To configure the built-in Ethernet port with Telnet

1. From your computer Windows desktop, click **Start** followed by **Run** (usually located in the lower right side of the **Start Menu**).
2. Type the following command: `telnet 192.168.000.001 9999`
3. Click **OK** to establish a Telnet connection. The following message appears:

```
MAC address XXXXXXXXXXXX (E.g., 00204A808BE8)
Software version V6.3.0.3RC3 (061110) (Version may vary by system)
```

Press Enter for Setup Mode

4. To enter **Setup Mode**, press **Enter** within 5 seconds. The configuration settings display, followed by the **Change Setup** menu.

Change Setup:

```
0 Server
1 Channel 1
5 Expert
6 Security
7 Defaults
8 Exit without save
9 Save and exit    Your choice?
```


5. Select an option on the menu by entering the number of the option in the “Your choice?” field and pressing **Enter**.



*The two menus recommended for review are “0 Server” and “1 Channel 1”. Bypass the other options listed in the menu.*

6. After selecting “0” for Server setup, confirm each value and press **Enter**.



*Under the “0 Server” option, the most commonly changed parameters include the IP Address and Port No, however, these are not required to be changed. Please confirm with Service before changing any other parameters. Refer to Service → .*

7. For “1 Channel 1,” confirm the current value and press **Enter**. No parameters under this option need to be changed.



*Parameters that should never be changed under “1 Channel 1” include:*

- Baudrate (230400)?
- I/F Mode (4C)?
- Flow (00)?

8. When finished, save the new configuration by pressing **9** (Save and exit) and **Enter**. The port will reboot after the configuration has been stored.



*All other Parameters should be left at default values unless the user is knowledgeable about configuring Ethernet.*

### 8.3 To configure the built-in Ethernet port with the Web Manager

1. Open your web browser and enter the IP address of the built-in Ethernet port. A login screen will display as shown in Figure 4–1 below.



Figure 16: Login window (Web manager)

2. Perform one of the following:
  - If no password has been defined (default), leave both fields blank and click **OK**.
  - If a password has been defined, leave the Username blank, type in the password and click **OK**.
3. The Web Manager displays the Home screen as shown in Figure 4–2 below. The menu displays on the left side of the window.

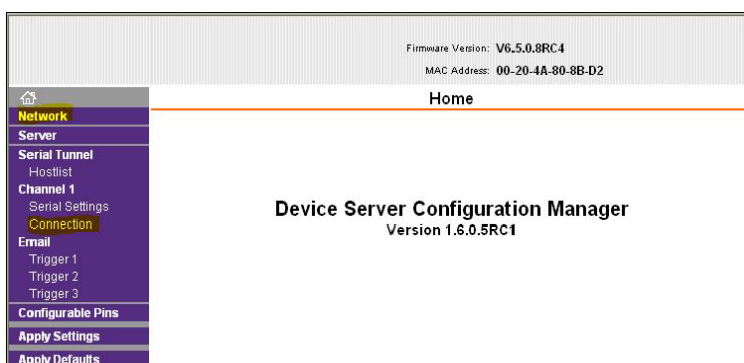


Figure 17: Home window (Web manager)



The “Network” and “Channel 1 Connection” menus are recommended for review (see highlighted menus in the figure). Bypass all other menus listed in the menu.

- The Network menu displays the Ethernet ports network settings, including the IP address. Refer to Figure 4–3 below.

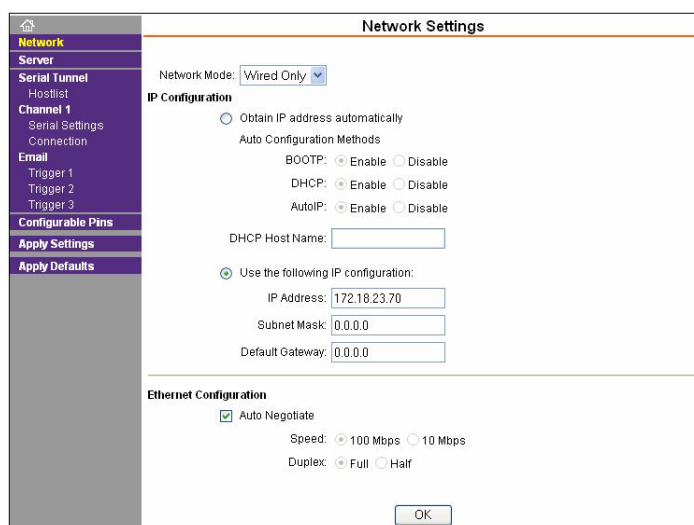


Figure 18: Network window (Web manager)

- Refer to “Network Mode” on page 4-5 to enter values for the Network menu.
- The Channel 1 Connection menu displays the Ethernet ports TCP connection settings, including the connection port. Refer to Figure 4–4 below.



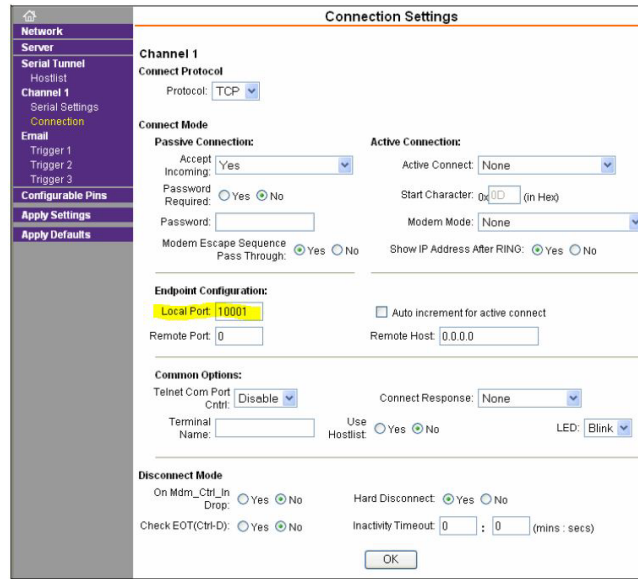


Figure 19: Connection window (Web manager)

- 7.
8. Refer to **“Channel Connection”** on page 4-7 to enter values for the Channel 1 Connection menu.



*In the “Channel 1 Serial Settings” menu, do not change the following parameters: Protocol (RS232), Flow Control (None), Baud Rate (230400), Data Bits (8), Parity (None), and Stop Bits (1).*

9. When finished, save and apply the configuration changes by clicking Apply Settings under the menu options. This will save the settings and reboot the Ethernet port. This function will take approximately 60 seconds.

*Clicking **OK** on each page does not change the configuration on the Ethernet port, but simply confirms which changes to use. Selecting “Apply Changes” will make the changes permanent and initiate a reboot.*



*All remaining parameters should be left at default values unless the user is knowledgeable in configuring the Ethernet.*

### 8.3.1 Network Mode

1. Click on Network from the menu bar on the Home window. The Network Settings window display.



*Network Mode: Wired Only is the only choice. This enables the Ethernet network connectivity.*

### 8.3.2 Automatic IP address configuration

An IP address can be assigned automatically, after which the related network settings can be entered.

#### 8.3.2.1 To assign an IP address automatically

1. From the Home window, click on **Network** from the menu bar to the left of the screen. The Network Settings window will display.
2. Select **Obtain IP address automatically**.
3. Enter the following, as necessary:
  - **BOOTP**: Select **Enable** to permit the Bootstrap Protocol (BOOTP) server to assign the IP address from a pool of addresses automatically. **Enable** is the default.
  - **DHCP**: Select **Enable** to permit the Dynamic Host Configuration Protocol (DHCP) to assign a leased IP address to the XPort Direct + unit automatically. **Enable** is the default.
  - **AutoIP**: Select **Enable** to permit the XPort Direct + to generate an IP in the 169.254.x.x address range with a Class B subnet. **Enable** is the default.
  - **DHCP Host Name**: Enter the name of the host on the network providing the IP address.

*Disabling BOOTP, DHCP and AutoIP (all three check boxes) is not advised as the only available IP assignment method remaining will be ARP or serial port.*

4. When finished, click the **OK** button.
5. From the Home window, click **Apply Settings** from the menu bar to save settings and initiate a reboot.

#### 8.3.2.2 Static IP address configuration

This function is performed to assign an IP address to the unit and enter the related network settings.

### 8.3.3 To assign an IP address manually

1. From the Home window, click Network from the menu bar. The Network Settings window displays.
2. Select Use the following IP configuration.
3. Enter the following, as necessary:
  - **IP Address**: If DHCP is not used to assign IP addresses, enter it manually in decimal-dot notation. The IP address must be set to a unique value in the network.
  - **Subnet Mask**: A subnet mask defines the number of bits taken from the IP address that are assigned for the host part.
  - **Default Gateway**: The gateway address, or router, allows communication to other LAN segments. The gateway address should be the IP address of the router connected to the same LAN segment as the unit. The gateway address must be within the local network.
4. When finished, click the **OK** button.
5. From the Home window, click **Apply Settings** from the menu bar to save settings and initiate a reboot.

## 8.4 Ethernet configuration

Specify the speed and direction of data transmission.

### 8.4.1 To specify how data will be transmitted

1. From the Home window, click **Network** from the menu bar. The Network Settings window displays.
2. Enter the following, as necessary:
  - **Auto Negotiate:** With this option, the Ethernet port auto-negotiates the speed and duplex with the hardware endpoint to which it is connected. This is the default.

If this option is not selected, complete the fields that become available:

- **Speed:** The speed of data transmission. The default is **100 Mbps**.
  - **Duplex:** The direction of the data transmission. The default is Full.
3. When finished, click the **OK** button.

### 8.4.2 Channel Connection

Use the following procedure to configure a channel's settings.

### 8.4.3 To configure a channel's TCP settings

1. From the Home window, click **Connection** from the menu bar. The Connection Settings window for the channel displays.
2. In the available fields, enter or modify the following information. As highlighted in Figure 4-4 on page 4-4, the main field to modify is the **Local Port**. The available fields include:
  - Connect Protocol
    - Protocol: From the drop-down menu, select TCP.
  - Connect Mode: Passive Connection
    - **Accept Incoming:** Select Yes to accept incoming connections. The default is Yes.
    - **Password Required:** Determines whether or not a password is required for an incoming passive connection. This field is not available when a password is set for Telnet mode.
    - **Password:** If Password Required was set to Yes, enter the password for passive connections.
  - Connect Mode: Active Connection
    - **Active Connect:** Select **None** to disable **Active Connect**. Otherwise, indicate the connection type from the drop-down list:
      - **With Any Character:** Attempts to connect when any character is received from the serial port.
      - **With Active Mdm Ctrl In:** Accepts external connection requests only when the modem\_control\_in input is asserted.
      - **With Start Character:** Attempts to connect when it receives a specific start character from the serial port. The default start character is a carriage return.
      - **Manual Connection:** Attempts to connect when directed by a command string received from the serial port.

- **Auto Start:** Automatically connects to the remote IP address and port after booting up.
  - **Start Character:** If Active Connect is set to With Start Character, enter the start character in this field.
  - **Modem Mode:** Indicates the on-screen response type when in Modem Mode (if Modem Mode is enabled).
  - **Show IP Address After Ring:** Indicates whether to display the remote IP address upon connection. The default setting is Yes.
- Endpoint Configuration
  - **Local Port:** Enter the local port number.
  - **Auto increment for active connect:** Select to auto-increment the local port number for new outgoing connections. The range of auto-incremented port numbers is **50,000** to **59,999** and loops back to the beginning when the maximum is reached.
  - **Remote Port:** Enter the remote port number.
  - **Remote Host:** Enter the IP address of the remote device.
- Common Options
  - **Telnet Com Port Cntrl:** This field is available for configuration only when **Active Connect** is set to **None**. Select **Enable** to permit Telnet communication to the unit. The **Telnet Com Port Cntrl** feature is used in conjunction with the Com Port Redirector (CPR) utility. Refer to the CPR online Help for details.
  - **Terminal Name:** This field is available for configuration only when Telnet Mode is set to **Enable**.

Use the terminal name for the Telnet terminal type. Enter only one name. When this option is enabled, the unit also reacts to the end of record (EOR) and binary options, which can be used for applications such as terminal emulation to IBM hosts.
  - **Connect Response:** A single character is transmitted to the serial port when there is a change in connection state. The default setting is **None**.
  - **Use Hostlist:** If this option is set to **True**, the device server scrolls through the host list until it connects to a device listed in the host list table. Once it connects, the unit stops trying to connect to any others. If this connection fails, the unit continues to scroll through the table until it connects to another IP in the host list.

The host list is disabled for Manual Mode and for Modem Mode. The unit will not accept a data connection from a remote device when the host list option is enabled.
  - **LED:** Select **Blink** for the status LEDs to blink upon connection or **None** for no LED output.
- Disconnect Mode

- **On Mdm\_Ctrl\_In Drop:** Set to **Yes** for the network connection to or from the serial port to disconnect (drop) when **Modem Control In** transitions from an asserted state to not asserted state. The default setting is **No**.
- **Hard Disconnect:** When set to **Yes**, the TCP connection closes even if the remote site does not acknowledge the disconnect request.
- **Check EOT (Ctrl-D):** Select **Yes** to drop the connection when **Ctrl-D** or **Hex 04** is detected. Both **Telnet Com Port Cntrl** and **Check EOT (Ctrl-D)** must be enabled for **Disconnect with EOT** to function properly. Ctrl-D is only detected going from the serial port to the network. The default setting is **No**.
- **Inactivity Timeout:** Use this parameter to set an inactivity timeout. The unit drops the connection if there is no activity on the serial line before the set time expires. Enter time in the format “mm:ss”, where “m” is the number of minutes and “s” is the number of seconds. To disable the inactivity timeout, enter **00:00**.


3. When finished, click the **OK** button.

## 8.5 General Information for Configuring Ethernet

For more information on configuring your computer for Ethernet connection, please refer to the Lantronix website below.

<https://www.lantronix.com/products/xport-direct/#product-resources>

## 9 Troubleshooting

This chapter presents recommendations and solutions to common operational problems, such as contamination, and excessive sampling gas temperatures and pressures. If your analyzer does not appear to be hampered by one of these related problems, refer to Table A-1 on page A-3 before contacting Service. Refer to *Service* → .

Troubleshooting resolutions in this chapter are confined to firmware operational issues only. For hardware related issues, refer to the Operating Instruction for your system.

### 9.1 Contamination

Contamination and long exposure to high humidity are valid reasons for periodically cleaning the gas sampling lines. Contamination in the gas sampling lines can potentially find its way to the sample cell and deposit on the optics or interfere with the measurement in some other way. Although the analyzer is designed to withstand some contamination, it is recommended to always keep the sampling lines as contamination free as possible. Refer to the Operating Instruction for instructions on keeping the sampling lines clean and cleaning the mirrors.

### 9.2 Excessive Sampling Gas Temperatures and Pressures

The analyzer is designed to produce accurate measurements only within the allowable cell operating range. Refer to the calibration report or the system drawings provided with the analyzer.



The cell temperature operating range for analyzers that are equipped with heated enclosures is equal to the enclosure temperature setpoint  $\pm 5$  °C.

Pressures and temperatures outside this range will trigger a **Pressure Low Alarm**, **Pressure High Alarm**, **Temp Low Alarm**, or **Temp High Alarm** fault.



If the pressure, temperature, or any other readings on the LCD appear suspect, they should be checked against the specifications. Refer to the calibration report or system drawings provided with your analyzer.

### 9.3 Peak Tracking Reset Procedure

The analyzer's software is equipped with a peak tracking function that keeps the laser scan centered on the absorption peak. Under some circumstances, the peak tracking function can get lost and lock onto the wrong peak. If the **PeakTk Restart Alarm** is displayed, the peak tracking function should be reset.

### 9.3.1 To reset the Peak Tracking function

1. Press the **#** key followed by the **2** key.

```

<SET PARAMETER MODE>
Enter password

NS 5.14-XXXX
```

The LCD prompts for a numeric password. Enter the user password (**3142**) on the keypad, then press the **\*** key to enter the number to enter **Mode 2** (Set Parameter Mode).

2. Press the **\*** key to cycle through the screens until the **Peak Tracking** parameter displays.

```

<SET PARAMETER MODE>
Peak Tracking
1
0:Off 1:On 2:Rst
```


3. Press **2** ('Rst' for reset) followed by the **\*** key. The peak tracking function will return the current analyzer midpoint to the factory default midpoint, and then automatically revert the parameter value to its setting before the reset was initiated. In most cases, the peak tracking should be set to **1** for ON.
4. Press the **\*** key to cycle through the screens until the **General Alarm DO** parameter displays.

```




<SET PARAMETER MODE>
General Alarm DO
2
0:L 1:NonL 2:Reset
```

5. Press **2** (Reset) followed by the **\*** key. The general fault relay and any active alarms will be reset to the 'normal' state. After the relay resets, this parameter will automatically revert to the setting before the reset was initiated.
6. Press the **#** key followed by **1** to return to **Mode 1** (Normal Mode).







## 9.4 Instrument Problems

If the instrument issue is not resolved through re-setting the Process Peak Tracking, refer to Table A-1 below before contacting Service (refer to *Service* → .

*Table A-1 Potential instrument problems and their solutions*

| Symptom  | Response  |
|--|---|
| Non-Operation (at start up)  | Refer to the Operating Instruction.   |
| Non-Operation (after start up)   | Refer to <i>Service</i> →    |
| <b>Laser Power Low Alarm</b>   | Press # 6 to capture diagnostic data and send the file to Endress+Hauser.   |
|  | Refer to the Operating Instruction.   |
| <b>Pressure Low Alarm</b> or <b>Pressure High Alarm</b> fault                      | Refer to the Operating Instruction.   |
| <b>Temp Low Alarm</b> or <b>Temp High Alarm</b> fault                              | Refer to the Operating Instruction.   |
| Front panel display is not lit and no characters appear                            | Refer to the Operating Instruction.   |
| Strange characters appear on front panel display                                   | Refer to the Operating Instruction.   |
| Pressing keys on front panel do not have specified effect                          | Refer to the Operating Instruction.   |
| System stuck in <b>Fit Delta Exceeds Limit</b> restart for greater than 30 minutes | Refer to <i>Service</i> →    |
| Not getting enough flow to the sample cell   | Refer to the Operating Instruction.   |
| No reading on device connected to current loop                                     | Refer to the Operating Instruction.   |
| Current loop is stuck at 4 mA or 20 mA   | Check display for error message. If alarm has been triggered, reset the alarm.  |
|  | Refer to the Operating Instruction.   |
| Reading seems to always be high by a fixed amount                                  | Capture diagnostic data and send the file to Endress+Hauser (see <i>To read diagnostic data with HyperTerminal</i> →  ). |



|   |  |
|---|--|
| Reading seems to always be high by a fixed percentage           | Capture diagnostic data and send the file to Endress+Hauser (see <i>To read diagnostic data with HyperTerminal</i> →  ).                    |
|   | Check that Peak Tracking is enabled (see <i>To change parameters in Mode 2</i> →  ).  |
| Reading displays 0.0 or seems relatively low                    | Capture diagnostic data and send the file to Endress+Hauser (see <i>To read diagnostic data with HyperTerminal</i> →  ).                    |
| Reading is erratic or seems incorrect                           | Refer to the Operating Instruction to check for contamination in the sample system.  |
|   | Capture diagnostic data and send the file to Endress+Hauser (see <i>To read diagnostic data with HyperTerminal</i> →  ).                    |
| Reading goes to “0”   | If <b>4-20 mA Alarm Action</b> is set to <b>1</b> , look on display for an error message (see <i>To change parameters in Mode 2</i> →  ). |
|   | Refer to the Operating Instruction.  |
| Reading goes to full scale                                      | If <b>4-20 mA Alarm Action</b> is set to <b>2</b> , look on display for an error message (see <i>To change parameters in Mode 2</i> →  ). |
|   | Refer to the Operating Instruction.  |
| Serial output is displaying garbled data                        | Refer to the Operating Instruction.  |
| Serial output is providing no data                              | Refer to the Operating Instruction.  |
| LCD does not update. Unit is locked up for more than 5 minutes. | Refer to the Operating Instruction.  |

## 10 Service

For Service, refer to our website (<https://endress.com/contact>) for the list of local sales channels in your area.

### 10.1 Before contacting Service

Before contacting Service, prepare the following information to send with your inquiry:

- Diagnostic downloads using the procedures provided in “**Receiving Serial Data (Customer Port Output)**” on page 3-1 or using AMS100 software from Endress+Hauser.
- When capturing this data, please include the following information to expedite your request:
- Analyzer Serial Number (SN) in the filename of the download, e.g., Diagnostic Data Download SN XXXX, where ‘XXXX’ is the serial number.
- **Mode 6 (#6)** download of the process sample.
- **Mode 6 (#6)** download of the validation gas, if the analyzer is designed to be connected to the sample port.
- Parameter list in the captured data.
- **Mode 1 (#1)** data in the captured data (approximately 5 minutes).

The **Mode 6 (#6)** process spectral data, the parameter list, the validation gas spectral data and the 5 minutes of **Mode 1 (#1)** data can all be provided in the same .txt file.

With your download information, please also include:

- Contact information.
- Description of the problem or questions.

Access to the information above will greatly expedite our response to your technical request.

### 10.2 Disclaimers

Endress+Hauser accepts no responsibility for consequential damages arising from the use of this equipment. Liability is limited to replacement and/or repair of defective components.

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