ECOTECH

environmental monitoring

EC9850H

High Level Sulfur Dioxide Analyser

Addendum
Revision: B
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Tel: (+61) 1300 364 946. **Fax:** (+61) 1300 668 763.
E-mail: ecotech@ecotech.com.au
Spare Parts parts@ecotech.com.au
Address: **International - Head Office**
1492 Ferntree Gully rd Knoxfield Victoria, 3180, Australia

This Addendum to the EC9850 manual contains information relating to the EC9850H High Concentration Sulfur Dioxide Analyzer. It replaces some sections of the EC9850 manual and should be read in conjunction with the manual.

Table of Contents Page

Revision History

Rev	Date	Summary	Affected Pages
A	October 2003	Release.	All
B	January 2007	Updated specifications, language, company address and PDF links created.	All

Operation Manual section

1.0 SCOPE AND APPLICATION

The EC9850H Sulfur Dioxide (SO_2) analyzer is an ultraviolet (UV) fluorescence spectrometer designed to continuously measure low concentrations of SO_2 in ambient air. The 9850H is capable of measuring higher concentrations than the 9850B.

Note

The following specifications for the EC9850H are different to the specifications listed in the EC9850 manual.

1.1 Specifications

Range

Dispay: Autoranging 0 to 400 ppm. Resolution = 0.1 ppm..

Analog output: 0-full scale from 0-50 ppm to 0-400 ppm with 0, 5, and 10% offset (with optional 50-pin I/O board).

Autoranging between 2 user-specified full scale values.

USEPA designated range: Not applicable

Noise (RMS)

Measurement process: 0.1% of concentration reading, with Kalman filter active*

Analog output: 0.1% of analog output full scale.

Lower Detectable Limit

Measurement process: Less than 0.2% of full scale concentration reading.

Analog: 0.2% of analog output full scale.

Zero Drift

Temperature dependent, 2.0 ppb per °C

Time dependent, at fixed temperature:

24 hours: Less than 1.0 ppm

Span Drift

Temperature dependent, 0.1% per °C

* Kalman filter is not supported above 20ppm. Default filter is now 30seconds.

Time dependent, at fixed temperature:

24 hours: Less than 0.5% of reading

30 days: Less than 0.5% of reading.

Lag Time

Less than 20 seconds.

Rise/Fall Time, 95% of Final Value

Less than 100 seconds (0.65-1.08 slpm flow) with Kalman filter active.*

Linearity Error

±1% of full scale (from best straight-line fit).

Precision

0.5 % of reading.

Sample Flow Rate

1.08 slpm. (standard)

Sample Pressure Dependence

A 5% change in pressure produces less than 1% change in reading.

Temperature Range

5° to 40° C (41° to 104° F)

USEPA designated range: Not applicable

Eignungsgeprüft Range: Not applicable

Power

99 to 132 VAC, 198 to 264 VAC, 47 to 63 Hz

USEPA designated range: 105 to 125 VAC, 60 Hz.

Weight

21.3 Kg (47 lb).

Analog Output

Menu selectable current output of 0-20 mA, 2-20 mA, and 4-20 mA.

* Kalman filter is not supported above 20ppm. Default filter is now 30seconds.

Optional voltage output with 50-pin connector board. Jumper selectable voltage output of 100 mV, 1 V, 5 V, and 10 V, with menu selectable zero offset of 0, 5%, or 10%.

Digital Output

Multidrop RS232 port shared between analyzers for data, status, and control.

DB50 with discrete status, user control and analog output.

1.2 U.S. EPA Equivalent Method

There is no U.S. EPA reference or equivalence designation for the 9850H due to the different range of this instrument.

2.0 Installation and Operation

Note

The following sections for the EC9850H are different to the sections in the EC9850 manual.

2.1.2.3 Sample Gas Connections

The 9850H requires at least 1.50 slpm (1.08 slpm sample plus 50% overflow) of particulate-filtered (<5 micron), dry (noncondensing) sample furnished at all times. An optional 5 micron inlet filter is available.

2.1.2.4 Exhaust Connections

Connect the exhaust port of the analyzer to vacuum pump capable of 1.0 slpm at between 100 - 300Torr absolute pressure (as displayed in the GAS PRESSURE parameter in the INSTRUMENT STATUS menu.) In the 9850H it is important to maintain the vacuum within this range. If the vacuum is outside this range, the primary screen will display the INSTRUMENT FAULT "ZERO FLOW", being either caused by a blockage or a leak, or insufficient pump vacuum. In the 9850H, if the GAS PRESSURE (INSTRUMENT STATUS menu) is not within the operating range 100-300 Torr (absolute) the 9850H will not give valid concentration readings. If less than 100 Torr, the instrument assumes there is a flow blockage. If the pressure is greater than 300 Torr, the instrument assumes the pump is faulty or not connected.

The exhaust of the pump should be connected to a manifold to vent the exhaust gas away from occupied areas. If desired, a charcoal exhaust scrubber may be placed in the exhaust line.

Note

Flow rate is not measured in the 9850H.

It is advisable that the user install a vacuum gauge on the exhaust line and periodically check that sufficient vacuum is being maintained.

2.1.2.5 Zero Air Connection

Caution

Sample and zero air connections to the EC9850 should be maintained at ambient pressure, with any excess flow vented to the atmosphere.

Connect a charcoal scrubber (or other source of zero air) to the Auxiliary port of the analyzer. The EC9850H requires at least 1 slpm of filtered (<5 micron), dry (noncondensing), SO_2-free air to be supplied during background cycles. This can either be from a charcoal scrubber canister or an active zero air generation system.

In plant applications where the background levels are high, use a good scrubber system to ensure reliable background zero. You may need a larger capacity scrubber due to the higher concentrations in the ambient air.

If during calibration, the calibration zero gas produces a negative reading on the instrument, this is usually because the background scrubber requires new scrubber material.

An optional zero air scrubber is available from **Ecotech Pty. Ltd.**

2.5.1 Primary Screen

The 9850H will display the data with one decimal place resolution.

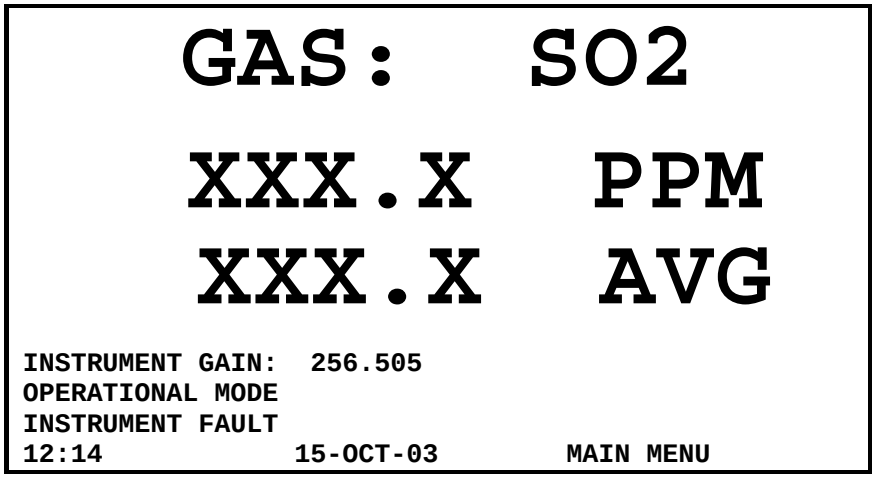

Figure 2-7. Primary Screen

2.5.4 Measurement Menu

```
MEASUREMENT MENU

UNIT SELECTION     PPM
AVERAGE PERIOD   : 1 MINUTE
FILTER TYPE      : 30 SECONDS
NOISE            : 0.204 PPB
```

Figure 2-10. Measurement Menu

FILTER TYPE

Sets the time constant of the digital filter. Choices are `NO FILTER`, `90 SECONDS`, `60 SECONDS`, `30 SECONDS`, `10 SECONDS`, or `KALMAN` (adaptive). Preliminary software versions do not support the Kalman filter. It is recommended that the `FILTER TYPE` be set to `30 SECONDS`.

NOISE

The standard deviation of the concentration. The manner in which this is done is as follows: (1) Take a concentration value once every two minutes; (2) Store 25 of these samples in a first-in last-out buffer; (3) Every two minutes, calculate the standard deviation of the current 25 samples. This is a microprocessor-generated field and cannot be set by the operator.

Note

The `30 SECOND` filter is the factory default setting.

Note

This reading is only valid if zero air or a steady concentration of span gas has been supplied to the analyzer for at least one hour.

2.5.5 Calibration Menu

```
CALIBRATION MENU

CALIBRATION        : TIMED
INTERVAL           : 24
STARTING HOUR      : 0
SO2 TIMED SPAN     : 10.00 PPM
CALIBRATION        : INTERNAL
SPAN COMP          : DISABLED
SO2 SPAN RATIO     : 1.0000
BACKGROUND         : START
BACK INTERVAL      : 24 HOURS
```

Figure 2-12. Manual Calibration Menu

SO2 TIMED SPAN

Note that in the 9850H the SO2 TIMED SPAN parameter is displayed with two decimal places.

Digital setting of the span concentration the operator expects the instrument to read during an AZS cycle. An entry is required only if SPAN COMP is ENABLED.

BACK INTERVAL

In the 9850H, the background frequency is user selectable. This field determines the frequency of the automatic zero cycle. Currently the options are 6, 8, 12 or 24 HOURS. This best results are achieved when this is set to 6 HOURS.

2.5.12.1 SO_2 Current Output Menu

```
          SO2 OUTPUT MENU

RANGE          : 0.500 PPM
OUTPUT TYPE    : CURRENT
CURRENT RANGE  : 0-20 MA
FULL SCALE     : 0.00 %
ZERO ADJUST    : 0.00 %
OVER RANGE     : 20.00 PPM
OVER-RANGING   : DISABLED
```

Figure 2-19. Analog Output Menu (Current Output)

In the 9850H, the range and over range values can be set anywhere between 0.1PPM and 500 PPM. Typical settings are RANGE 100.000 PPM and OVER RANGE 400.000 PPM.

2.5.12.2 SO_2 Voltage Output Menu

```
          SO2 OUTPUT MENU

RANGE          : 0.500 PPM
OUTPUT TYPE    : VOLTAGE
OFFSET         : 0    %
FULL SCALE     : 0.00 %
ZERO ADJUST    : 0.00 %
OVER RANGE     : 20.00 PPM
OVER-RANGING   : DISABLED
```

Figure 2-20. Analog Output Menu (Voltage Output)

In the 9850H, the range and over range values can be set anywhere between 0.1PPM and 500 PPM. Typical settings are RANGE 100.000 PPM and OVER RANGE 400.000 PPM.

2.5.14 Instrument Status Screen

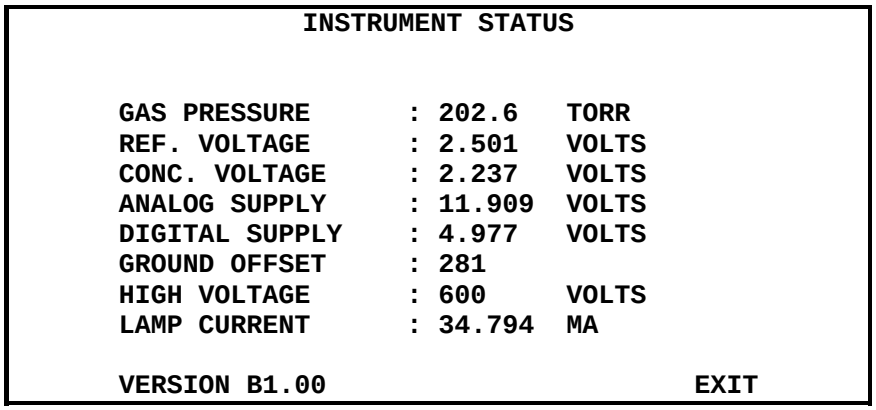

Figure 2-22. Instrument Status Screen

INSTRUMENT STATUS is information continuously generated by the microprocessor for various parameters.

GAS FLOW
The gas flow is not shown in the 9850H.

HIGH VOLTAGE

High Voltage is reduced to 600 Volts in the 9850H.

Note: All other parameters are similar to the 9850B.

3.1 Overview

References made to USEPA designated equivalent method do not apply to the 9850H.

Important

Use of the EC9850B SO_2 analyzer as a USEPA designated equivalent method requires periodic multipoint calibration in accordance with the procedure described below. In addition, the instrument must be set to the parameters indicated in *Chapter 1*.

3.2.1.3 Reagents

3.2.1.3.1 SO_2 Concentration Standard

The cylinder of SO_2 in air or nitrogen must contain the appropriate concentration of SO_2 suitable for the selected operating range of the analyzer under calibration. For the 9850H, higher concentration gas standards will be required for dilution to the analyzer's concentration range.

If during calibration, the calibration zero gas produces a negative reading on the instrument, this is usually because the background scrubber requires new scrubber material.

3.2.1.3.2 Dilution Gas

The 9850H is frequently used in applications where the background (ambient) levels of SO_2 are relatively high. In these applications where the background levels are high, use a good scrubber system to ensure reliable background zero. You may need a larger capacity scrubber due to the higher concentrations in the ambient air.

If during calibration, the calibration zero gas produces a negative reading on the instrument, this is usually because the background scrubber requires new scrubber material.

The 9850H block diagram is illustrated in the revised Figure 4.

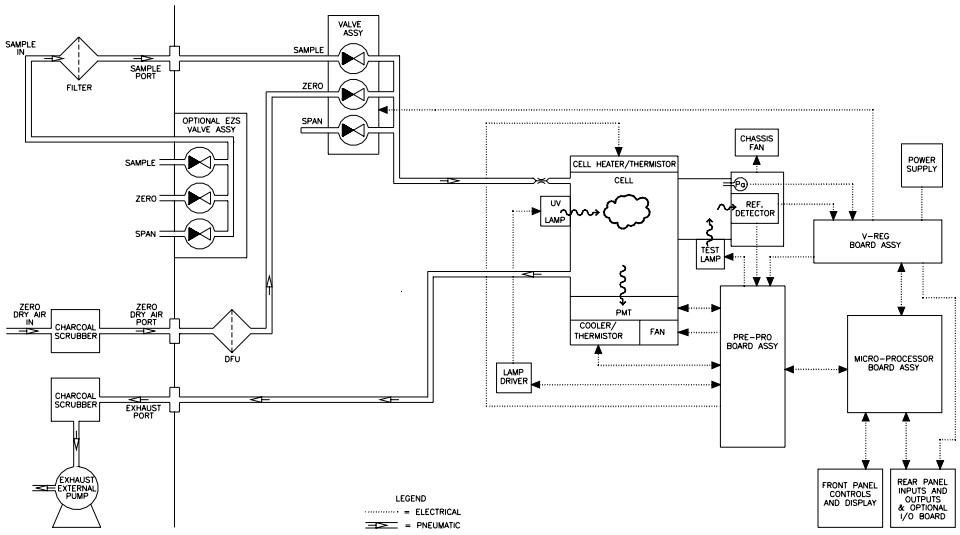

Figure 4. System Block Diagram

2.1.2 Sensor Module

The 9850H is similar to the 9850B with the following changes:

2.1.2.1 Pneumatics

The 9850H pneumatic system flow is illustrated in the revised Figure 6.

The hydrocarbon kicker is not fitted in the 9850H.

The sample air is not mixed with zero air as it is in the 9850B. Only the sample flow (approximately 1.0 slpm) exits the exhaust port.

Interference by hydrocarbons in the higher range of the 9850H SO_2 measurement process is minimal.

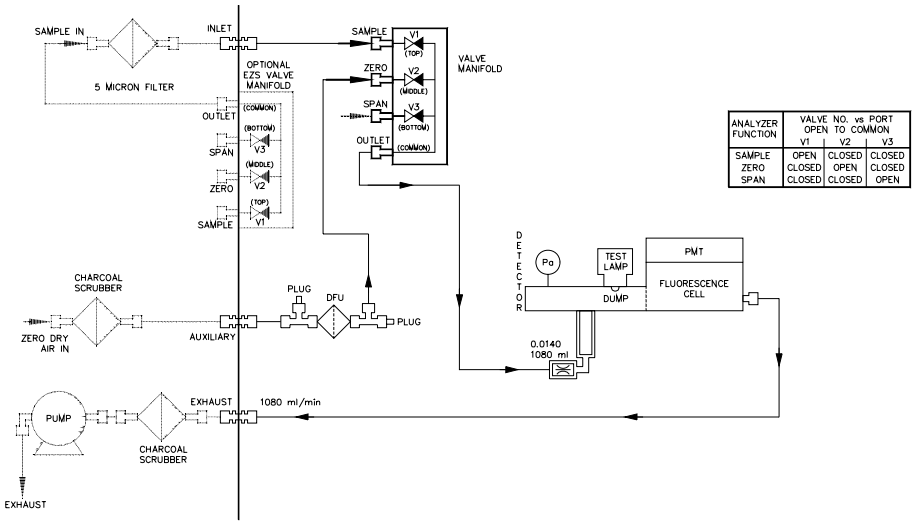

Figure 6. Pneumatic Diagram

Hydrocarbon Kicker. The hydrocarbon kicker is not fitted in the 9850H.

Zero Air Scrubber. An optional external charcoal scrubber is available. It is used to provide a clean SO_2-free zero air supply for the automatic zero function of the instrument.

Flow Control. The flow is not controlled in the 9850H. The Detector/Pressure PCA monitors sample pressure only.

2.1.2.2 Optics

The optics in the 9850H are basically the same as the 9850B analyzer, except that the colored glass filter is an optical bandpass filter centred on 360 nm, and the UV-sensitive photomultiplier tube is 9850H type.

Photomultiplier Tube (PMT). The wavelength of light that the PMT detects in the 9850H is 360 nm.

3.1.3 Zero Air Scrubber

2. The front panel SO_2 reading resolution is as follows:

Note

This value should be 0.0 ± 0.1 ppm. If it is not, a background should be initiated by choosing `CALIBRATION MENU` and `BACKGROUND: START`, then press <Enter> to re-establish the zero baseline. The background will require approximately 15 minutes to complete.

3.1.6 Orifice Removal for Replacement or Cleaning

The orifice is located in a male elbow, not in the tee as shown. The procedure is the same. Figure 8 should show a male elbow.

3.2 Replaceable Parts

The replacable parts are the same as for the 9850B with the following exceptions:

EC9850H Analyzer Spare Parts Requirements		
Description	**Part Number**	**Level**
Filter, glass, U360	002-056200	3
Photomultiplier tube	PMT9781B	3
Orifice, 14 mil	98000180-13	3

3.3.2.6 System Faults

The 9850H displays the following fault in a different way to the 9850B. All other faults are unchanged.

System Fault Messages	
Message	**Description/Failure Limits**
`ZERO FLOW`	Indicates that the cell pressure from the Pressure PCA is less than 100 Torr, which is either due to plugged orifice or other blockage, or greater than 300 torr (pump worn or other leak).