

OZONE ANALYZER BMT 963

Manual

Rev. 05/99

1. General Description

The OZONE ANALYZER BMT 963 is a microprocessor-based dual beam photometer (UV 254 nm) for measuring the ozone content in air or oxygen.

The ozone content is displayed in one of the two different dimensions: weight percent of ozone (%wt/wt), or grams of ozone per normal cubic meter of sample gas (g/Nm^3), depending on the dimension specified with the order. Please be aware of the fact that these dimensions are not correlated linearly!

To evaluate the ozone content in the sample gas the OZONE ANALYZER BMT 963 measures the UV radiation in the measurement channel, the UV radiation in the reference channel, the temperature in the cuvette, and the atmospheric pressure (VENT version), or the pressure inside the cuvette (PRESS version). Refer to page 6 concerning the VENT and PRESS configuration!

2. Installation and Power Connection

The OZONE ANALYZER BMT 963 is a 144 x 72 mm front panel instrument (according to DIN 43700). The mounting cut-out should be 139 x 67 mm (W x H). Depth is approx. 230 mm. The power line voltage may be 90 to 250 VAC (50 or 60 Hz).

The installation of the power connector (pluggable terminal block) has to be made by a person acquainted with the problems involved. Do not connect or disconnect the voltage-carrying terminal block!

For the sample gas connection 3 x 5 mm PTFE tubing (or FEP tubing 1/8" x 3/16") should be used (which we will supply on request). The sample gas has to be connected via the sample gas filter ("IN"). The time lag of the concentration measurement depends on a) the flow rate of the sample gas, b) the length of the tubing to the analyzer, c) the cross section of the tubing (we recommend tubing 3 x 5 mm, not more!), d) the time lag of the analyzer itself. At the recommended flow rate of .2 to 1 l/min time lag will be 2.5 to 1.5 s with a tubing length of 1 m..

With the VENT version of the OZONE ANALYZER BMT 963 care should be taken in choosing the length of the tubing between the analyzer and the BMT Catalyzing Cartridge to avoid unnecessary pressure drop. Tubing length should be no longer than about 30 cm.

OZONE ANALYZER BMT 963

OUTPUT AND CONTROL TERMINALS

ALWAYS CONSULT THE MANUAL

USE SHIELDED CABLE CONNECT SHIELD TO \perp

ANALOG OUTPUTS:

Isolated

- 7 Concentration 0-10V
- 6 GND (10 V)
- 5 Concentration 4-20 mA
- 4 GND (4-20 mA)

BINARY OUTPUT:

Relay, isolated, $U_{max} = 30 \text{ VDC}$, $I_{max} = 1 \text{ A}$

- 8 Contact ■ Lamp Low
- 9 Contact ■ Cuvette Dirty
- Purge Command

ERROR RELAY:

Isolated, $U_{max} = 30 \text{ VDC}$, $I_{max} = 1 \text{ A}$

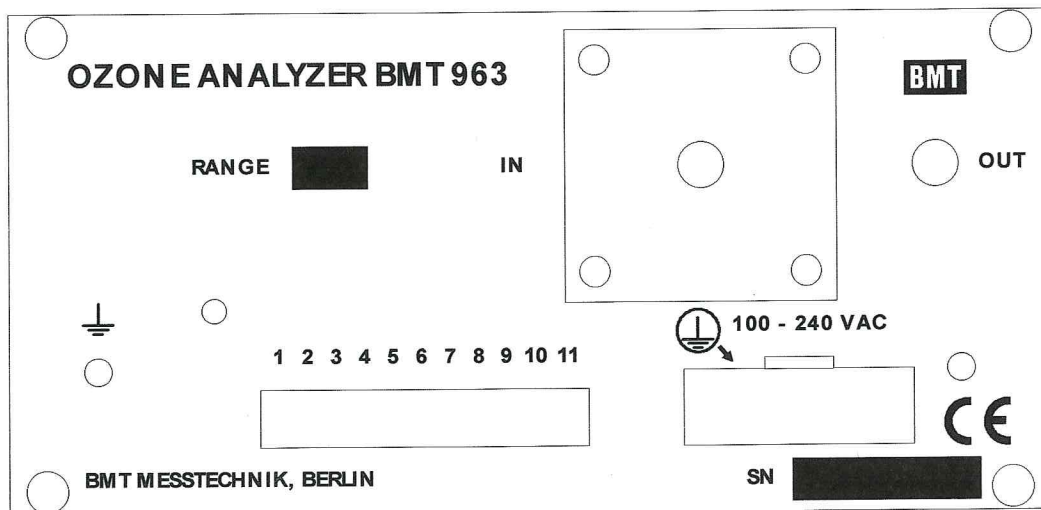
- 1 Common
- 2 Normally Open
- 3 Normally Closed

BINARY INPUT:


24 VDC, isolated, current limited to 6 mA

- 10 GND (input)
- 11 Set to Zero (no O_3)

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3. Output and Control Terminals

All signal leads should be shielded. The shield should be connected to the "golden" ground terminal () of the instrument via an 1/4" FASTON connector.

Analog Outputs:

The output signals are updated about 14 times per second.

The voltage output is an isolated voltage signal 0 to 10 V, proportional to the concentration (actually this signal swings down to about -0.25 V below zero). Input resistance of the load should be higher than 1 kW.

The current output is an isolated current signal 4 to 20 mA, proportional to concentration. Input resistance of the load should be less than 650 W (optional 1350 W). The current output provides the energy for the current loop. **Attention:**

The current output must not be connected to an external power supply!

Binary Input:

The binary input is to trigger the ZERO function of the OZONE ANALYZER BMT 963. Applying a voltage of typ. +24 VDC (10 V - 40 V) for about 0.5 s will set the analyzer to zero reading. The ZERO function may be triggered only after complete purging of the cuvette with air or oxygen (purging for at least 10 seconds plus delay of the input tubing)! Input current of the binary input is limited internally to about 6 mA. The input is protected against voltages with wrong polarity.

Binary Output:

The binary output is a relay contact (30 V/1 A) which can be assigned to one of the three following functions (please specify!):

- Lamp Low: early warning for a weakening UV lamp
- Cuvette Dirty: announcing dirty cuvette windows
- Purge Command: automatic purging of the cuvette every 12 or 24 hours (e.g. using a BMT Purge Unit, a combination of solenoid valve and air pump)

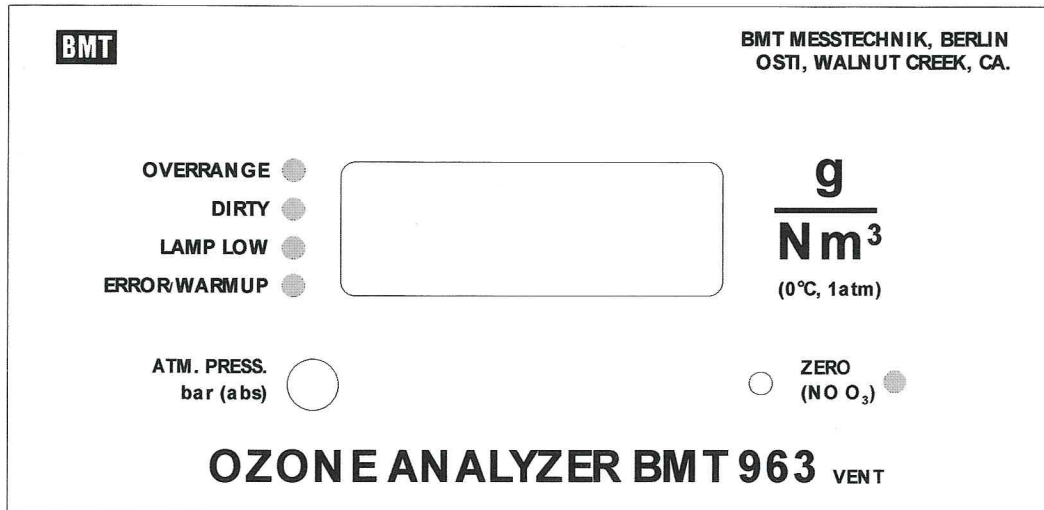
The assignment of the binary output is marked on top of the enclosure of the OZONE ANALYZER BMT 963 (Lamp Low if not specified).

Error Output:

The error output is an SPDT relay contact. In order to detect a broken wire we recommend to use the opening contact (Normally Closed \equiv closed without an error).

4. Front Panel

The front panel contains a 4-digit numeric concentration display, and five red annunciator lamps (six in the PRESS version). The push button on the left switches the display to show the pressure (in bar abs). The PRESS version shows the pressure inside the cuvette (systemic pressure), the VENT version shows the atmospheric pressure.



With a pointed instrument (e.g. a ball pen, or a pencil) the OZONE ANALYZER BMT 963 can be set to zero through a hole on the right side of the front panel (ZERO). **The cuvette has to be free from ozone before the ZERO function is initiated!** In case the binary output is used for the Purge Command (to activate a solenoid valve and a pump for purging the cuvette) ZERO will activate a complete purging and zeroing cycle.

The analyzer stores the offset information even when it is switched off.

5. Switching On and Error Displays

After application of the mains voltage the instrument goes through a warm-up period which can last up to two minutes (depending on previous usage). At first the display starts counting down from 120 (decrementing by one, or by five if the instrument is still warm).

During warm-up the error relay is in the error state, the analog outputs put out their maximum values, ERROR/WARMUP (front panel) is blinking.

After count down the instrument starts to read out concentration values on the display and the analog outputs. The error relay goes into its normal state (no error present).

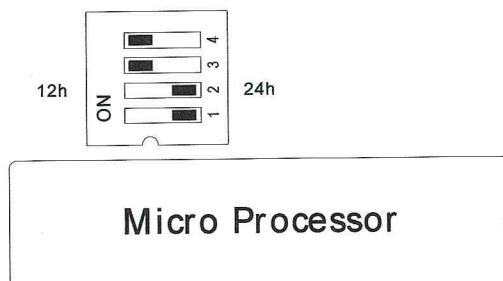
OVERRANGE

If the concentration exceeds the maximum range of the instrument, it will display that maximum value. The analog outputs will put out 10 V and 20 mA, respectively. Both annunciators **OVERRANGE** and **ERROR/WARMUP** will flash. The error relay will be in its error state. If the concentration decreases beyond maximum range the instrument will resume normal operation.

PURGE COMMAND

If the Binary Output has been ordered as Purge Command (instead of Lamp Low, or Cuvette Dirty) the output relay contact is activated every 12 or 24 hours to switch on e.g. an external 3-way solenoid valve and an air pump with particle filter, to perform a complete fully automatic zeroing cycle. In the Cabinet version BMT 963 C the Binary Output is always set to Purge Command. The user has to provide for zero gas in the cuvette during the zeroing cycle. The Purge Command function cannot be switched off.

Factory setting of the purging interval is 24 h. This period can be changed to 12 h using the DIP switch on the main PC board as shown below (to open the instrument, four screws on the rear panel have to be removed).



The zeroing cycle starts with activating the Binary Output contact for 12 seconds. Then the instrument is zeroed for 1 second. Now the contact is deactivated for 12 seconds to allow the cuvette to completely be refilled with sample gas, whilst the display shows the level of contamination (see below: **DIRTY**). During the whole zeroing cycle the **ZERO** lamp is flashing, and the analog outputs are holding the last valid ozone concentration signal.

Ten minutes after power-on the first zeroing cycle is initiated. Automatic zeroing may also be initiated by pressing **AUTO ZERO** on the front panel. The 12/24 h purging interval is re-set with each purge cycle, automatic or manual.

The OZONE ANALYZER BMT 963 may be ordered equipped with an Internal Purge Unit (3-way solenoid valve and air pump with particle filter) as an option.

DIRTY

During each zeroing action of the OZONE ANALYZER BMT 963 (if an external solenoid valve and air pump are used: every 12 or 24 hours) the instrument will test the cuvette for contamination. If the contamination exceeds a certain level **DIRTY** and **ERROR/WARMUP** will be flashing. The contact of the binary output will open (if its function is determined to be Cuvette Dirty). The error relay will switch to its error state.

An indicator for the level of contamination is displayed at the end of the zeroing phase. The value of about 0.90 indicates a clean cuvette. Below about 0.70, the cuvette should be sent in for cleaning, and below 0.41 the lamp DIRTY is blinking.

During operation with a dirty cuvette concentration results will still be displayed and put out. But the accuracy of the results may be jeopardised. Cleaning the cuvette and, of course, replacement of the filter insert is recommended. In case the OZONE ANALYZER BMT 963 was switched off with DIRTY blinking it will resume operation in this state after being switched on again. It will continue in this error state until a zeroing action with a cleaned cuvette has been performed.

LAMP LOW

The OZONE ANALYZER BMT 963 will give a warning near the end of the UV lamp's life by LAMP LOW blinking. The contact of the binary output will open (if its function is determined to be Lamp Low). The accuracy of measurement is not impaired. As to our experience there is enough time to prepare for a replacement of the UV lamp. If the aging goes too far, the error relay changes to its error state and ERROR/WARMUP is blinking. In this mode of operation results will still be displayed and put out, but inaccuracies may occur. Replacement of the UV lamp by the manufacturer is recommended.

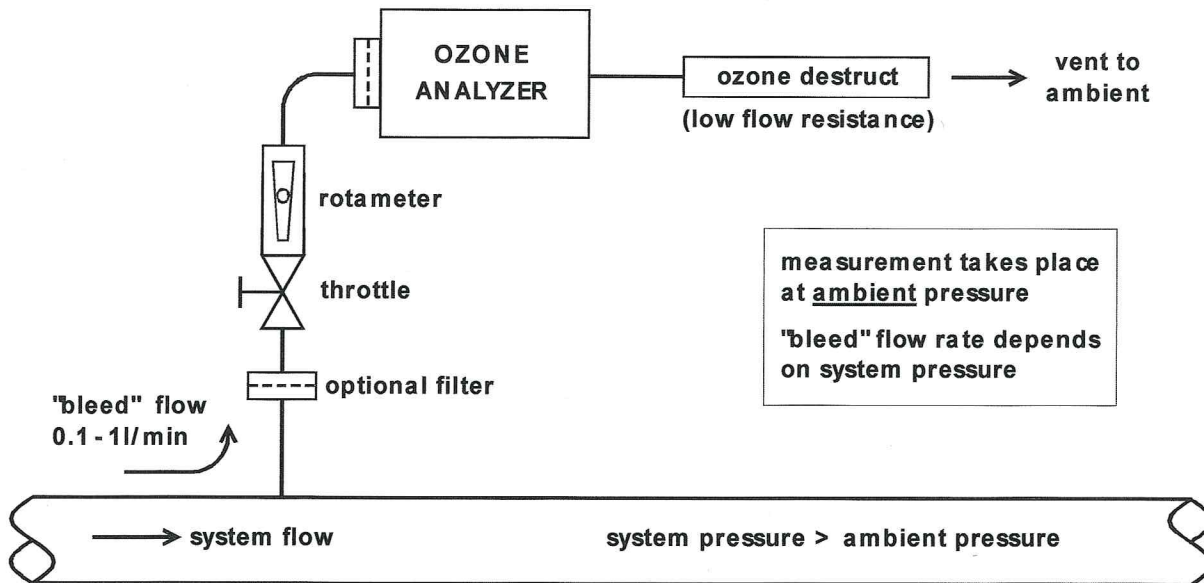
When the UV lamp fails completely the display will be blanked. The analog outputs will put out their maximum values (10 V and 20 mA, respectively).

ERROR/WARMUP

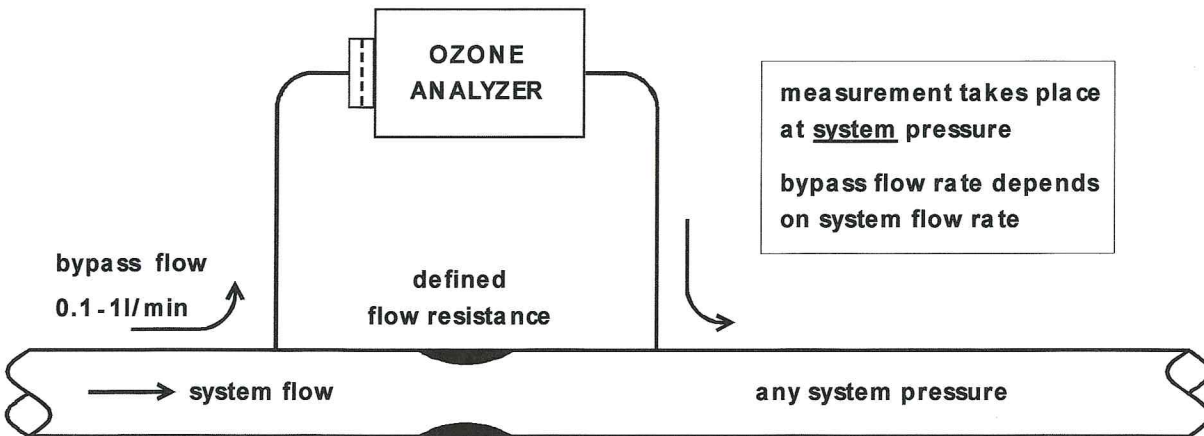
Every error mentioned above (the lamp low warning is no error), including failure of the processor, will result in ERROR/WARMUP being blinking. The error relay will go into its error position. With no power applied the error relay is in its error position, but ERROR is not blinking, of course.

OVERPRESSURE (PRESS version only)

Both OVERPRESSURE and ERROR/WARMUP will blink if the pressure inside the cuvette exceeds the operating pressure range (indicated on the rear panel). The error relay will go into its error position. Concentration results will still be available in this mode of operation, but inaccuracies may occur. Eventually the pressure sensor may be damaged or its accuracy may be deteriorated (if the peak pressure was higher than about twice the operating pressure range). This could lead to erroneous results even if the pressure has dropped into the operating range of the pressure transducer. After the pressure signal has decreased to below the indicated operating pressure range the instrument will resume normal operation.



VENT mode



PRESS mode