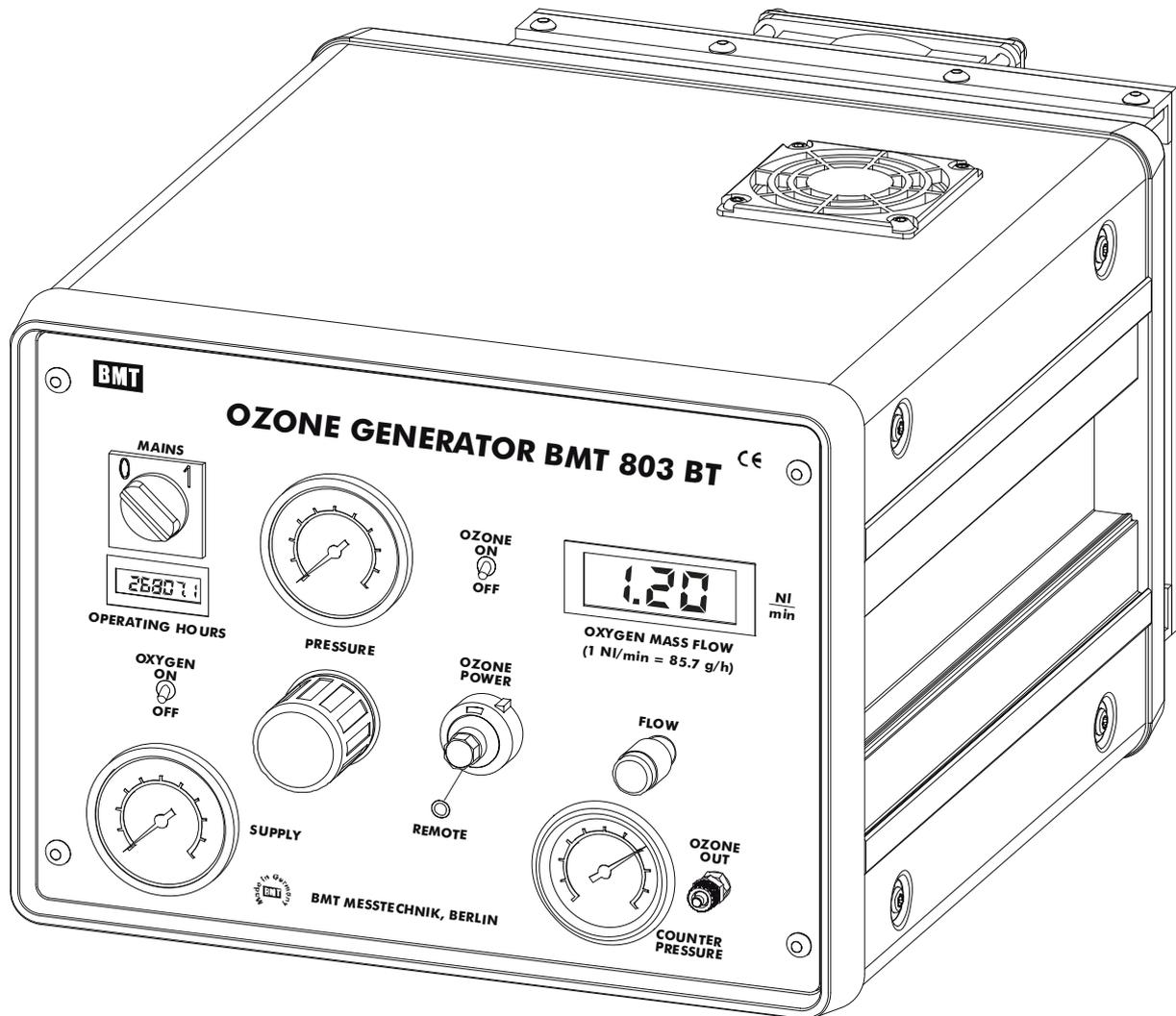


# OZONE GENERATOR BMT 803 BT

## Manual

Rev. 05/2014



## OZONE ANALYZER BMT 803 BT

This manual describes the basic version **BMT 803 BT**. For the operation of the OZONE ANALYZER BMT 964 (option **BMT 803 BTA**, see Appendix A) please consult the manual of the BMT 964.

### Contents

<b>1</b>	<b>General Description</b>	<b>3</b>
<b>2</b>	<b>Cautions and Warnings</b>	<b>3</b>
<b>3</b>	<b>Installation and Power Connection</b>	<b>5</b>
	<i>Remote Control</i>	5
<b>4</b>	<b>Operation</b>	<b>6</b>
<b>5</b>	<b>Maintenance</b>	<b>8</b>
<b>6</b>	<b>Troubleshooting</b>	<b>9</b>
<b>7</b>	<b>Specifications</b>	<b>10</b>
<b>8</b>	<b>Appendix A: Option Ozone Analyser</b>	<b>11</b>

## 1 General Description

The OZONE GENERATOR BMT 803 BT (Bench Top) is a small, air cooled ozone source for laboratory applications. Operation is from oxygen. The instrument contains every controls and displays necessary, and desirable, for operating the ozone generator, except for an ozone analyser. An external modified ozone analyser BMT 964 can be connected to two sample gas fittings at the rear of the BMT 803 BT. This in-line ozone analyser carries the complete ozone gas flow and thus does not waste any ozone gas for its operation.

The oxygen mass flow meter is independent of the pressure and temperature of the oxygen, and the flow is displayed in NI/min, one NI/min equaling 85.7 g/h oxygen.

The ozone-resistant pressure gauge COUNTER PRESSURE is connected directly to the outlet fitting and shows the ozone system counter pressure, the pressure into which the ozone gas at the outlet is flowing.

In addition to this system counter pressure the inlet oxygen pressure and the operating pressure of the generator are measured and displayed by a pressure gauge.

A check valve is installed between the mass flow meter and the ozone generating cell in order to protect the mass flow meter against ozone diffusing backwards after the inlet pressure of the oxygen source has returned to zero or the solenoid valve has been switched off.

Another check valve is installed at the outlet of the BMT 803 BT in order to prevent any fluids or dirt from the process entering the instrument backwards.

A switch driving a solenoid valve allows interruption of the oxygen gas flow. Another switch is provided to stop ozone generation without changing power settings.

Dimensions of the OZONE GENERATOR BMT 803 BT are 255 x 200 x 385 mm (10" x 8" x 15"). The weight is 10 kg. Input voltage is 230 VAC, or 115 VAC, to be specified with the order. The oxygen inlet fitting (on the rear) is for 4 x 6 mm (or 1/4" x 5/32") FEP (or PTFE) tubing. The ozone gas outlet fitting (on the front panel) is for 3 x 5 mm (or 1/8" x 3/16") FEP (or PTFE) tubing. Power consumption is 170 W max.

## 2 Cautions and Warnings

### Safety Precautions:

**WARNING: Ozone is a highly toxic gas. The concentrations produced by this generator are above the lethal limit. Appropriate safety devices (e.g. ozone detectors) should be used. In case of an ozone leak electrical energy and oxygen supply to the generator must be cut off immediately.**

**WARNING:** In order to avoid leaks the oxygen supply pressure must never, not even momentarily, exceed 4 barg. An oxygen-enriched atmosphere always means an increased fire hazard! Follow recommended oxygen handling practice. In ozone systems, always use appropriate means (e.g. safety relief-valves, oxygen sensors) to ensure avoidance of overpressures and the risks associated with oxygen.

**WARNING:** This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a fuse or circuit breaker minimum 3 A (Slow Blow) and not larger than 15 A at 115 VAC (10 A at 230 VAC) is used on the phase conductor.

**CAUTION:** Water should never be allowed to enter the generator. The internal circuitry may be damaged.

**CAUTION:** Do not run this generator in a humid, dusty or corrosive environment. Internal circuitry may be damaged.

**CAUTION:** The ambient temperature may not exceed 30°C. Air flow of the fan and through the openings may not be blocked. If the generator is installed in a larger system where temperature could exceed 30°C, temperature controlled automatic shut off of electrical energy and oxygen supply must be used. Due to the limited life of fans generators must be returned for service after 35,000 hours of operation.

**Caution:** Never operate the generator with the fittings unconnected! In case there is no analyser installed the two fittings in the backp plane must be connected to each other with a short piece of tubing. Make sure the tubing is not kinked, as this would restrict the complete flow through the generator.

Précaution de sécurité:

*Avertissement: L'ozone est un gaz à forte toxicité. Les concentrations d'ozone produit avec le BMT 803 BT vont au-delà de la limite mortelle. C'est pourquoi il convient d'utiliser une technique de sécurité adéquate (détecteur d'ozone). En cas d'une leakage d'ozone, l'alimentation de courant et d'oxygène doit être coupée instantanément.*

**Attention:** Le montage et le branchement au secteur devront être exécutés par une personne spécialement formée à cet effet. Le branchement et le débranchement sous tension sont interdits !

**Attention:** Ce produit est soumis à l'emploi d'un fusible de surintensité dans le bâtiment. Vérifiez que le fusible de la phase utilisée ne dépasse pas 15 A pour 120 VCA (10 A pour 240 VCA).

**Attention:** Ne pas utiliser cet instrument dans une atmosphère enrichie en oxygène (risque d'incendie)! Suivez les recommandations associées à l'utilisation de l'oxygène.

**Avertissement:** Débranchez avant d'ouvrir ce produit.

**Attention:** Ne jamais faites fonctionner ce générateur sans connexion à des raccords sur le panneau arrière!

**Attention:** L'eau ne devrait jamais être autorisé à entrer dans le générateur. Le circuit interne peut être endommagé.

**Attention:** Ne pas utiliser ce générateur dans un environnement humide, poussiéreux ou corrosifs. Circuit interne peut être endommagé.

### 3 Installation and Power Connection

The MAINS switch must be switched off before you connect the generator to the mains power.

**Do not connect or disconnect the voltage-carrying connector!**

**Warning:** This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a fuse or circuit breaker no larger than 15 A at 120 VAC (10 A at 240 VAC) is used on the phase conductor.

Installation is easy. The P & ID (Piping and Instrumentation Diagram) on page 7 illustrates the purpose of each component inside the generator.

A clean oxygen source delivering pure oxygen (or oxygen from a PSA) should be connected to the inlet at the rear. The inlet fitting accepts a 4 x 6 mm or 1/4" x 5/32" FEP (or PTFE) tubing, max. pressure allowed is 4 barg.

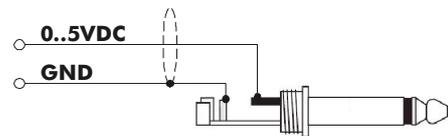
For correct flow measurements allow a warm-up of about 15 minutes.

An external OZONE ANALYZER BMT 964 may be connected to the generator. For this purpose, two fittings are provided at the back of the generator, marked with arrows indicating inlet and outlet. If no analyser is connected to the generator, these two fittings must be connected to each other. Never operate the generator with these fittings unconnected!

#### Remote Control

There are two ways of setting the electric power of the generator: In Internal Mode the setpoint is defined by a 10-turn potentiometer mounted in the front panel. Control range is approximately 15..100%. The Internal Mode is active if no 3.5mm connector is plugged into the REMOTE jack in the front panel.

External Mode is activated by plugging in the 3.5 mm connector to the front panel REMOTE jack. This enables the power to be set by an external voltage between 0 and 5VDC corresponding to approx. 15..100% electric generator power. During External Mode the internal potentiometer is disabled.

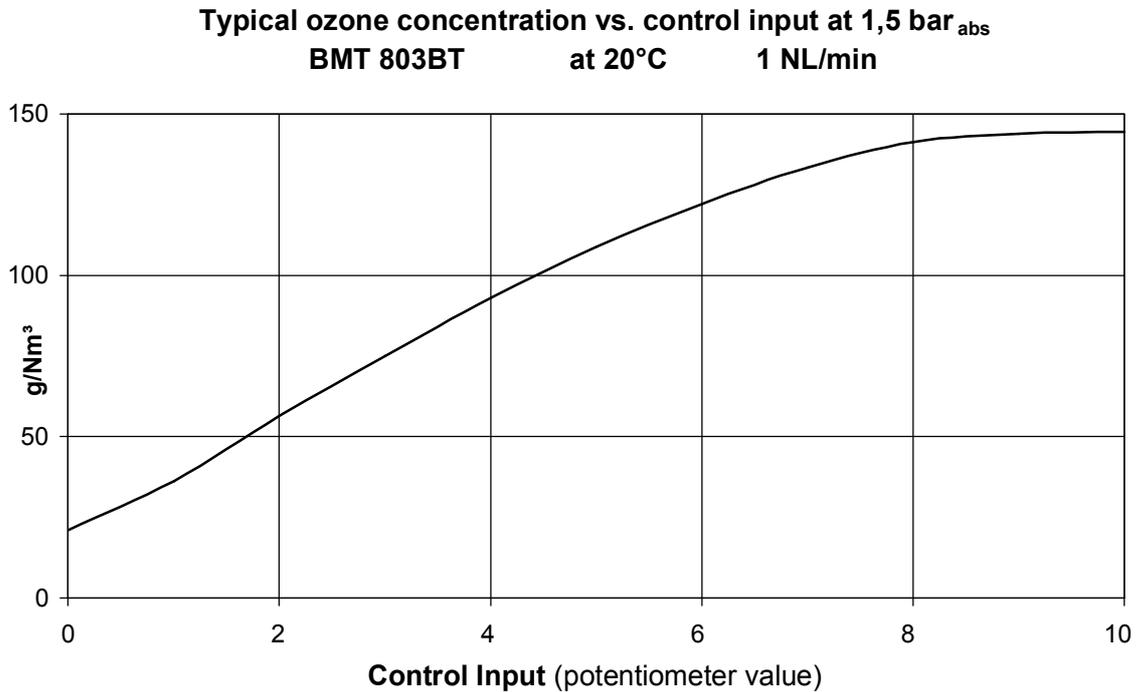


A suitable 3.5 mm connector for External Mode operation is provided with each BMT 803 BT.

**Important: For external mode always use a shielded cable!**

The ozone concentration produced by the generator is non-linearly related to the remote control voltage or the potentiometer settings.

The following curve shows the typical result in ozone concentration over power setting at a flow rate of 1 Nl/min:

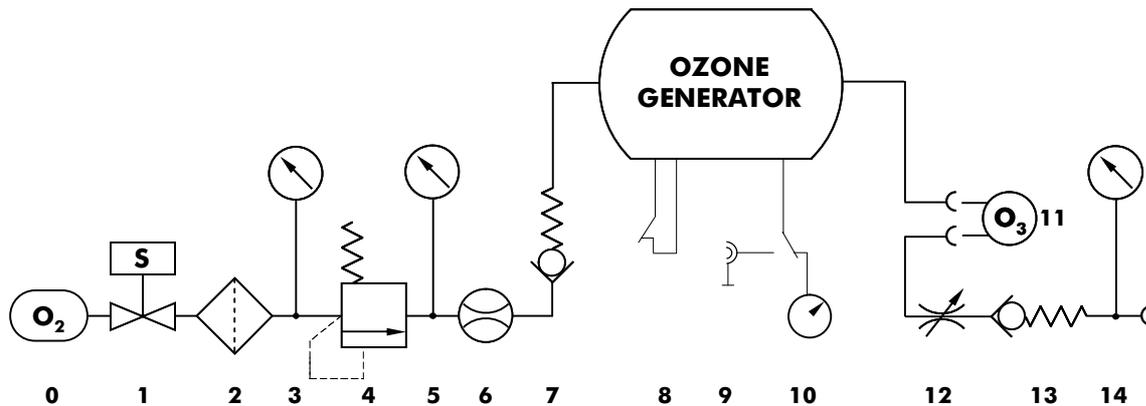


#### 4 Operation

It is assumed that the installation has been finished according to chapter 3 "Installation and Power Connection" before operating the ozone generator.

**WARNING: Ozone is a highly toxic gas. The concentrations produced by this generator are above the lethal limit. Appropriate safety devices (e.g. ozone detectors) should be used. In case of an ozone leak electrical energy and oxygen supply to the generator must be cut off immediately.**

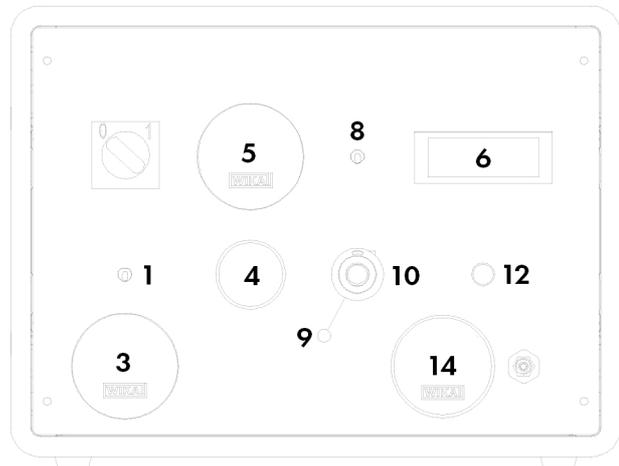
The following piping and instrumentation diagram illustrates the functioning of the ozone source:



- |  |                                       |
|--|---------------------------------------|
| <b>0 oxygen source (4 bar max.)</b>          | <b>8 ozone off</b>                    |
| <b>1 solenoid valve: O2 on/off</b>           | <b>9 remote control input</b>         |
| <b>2 particle filter</b>                     | <b>10 internal power control</b>      |
| <b>3 oxygen supply pressure</b>              | <b>11 external BMT 964 (optional)</b> |
| <b>4 pressure regulator (self relieving)</b> | <b>12 needle valve</b>                |
| <b>5 operating pressure</b>                  | <b>13 check valve</b>                 |
| <b>6 thermal mass flow meter</b>             | <b>14 counter pressure</b>            |
| <b>7 check valve</b>                         |                                       |

The operating pressure may be set from 0.1 to 1.0 barg using the pressure regulator in the front panel. The BMT 803 BT has been optimized for an operating pressure of 0.5 bar gauge. The operating pressure should never be set below the system pressure (counter pressure at the outlet).

At an operating pressure of 0.5 bar gauge (1.5 bars abs), an ozone concentration of 100 g/Nm<sup>3</sup>, 20°C ambient air temperature, the ozone production is typically 8 g/h. Maximally obtainable ozone concentration exceeds 250 g/Nm<sup>3</sup>. The ozone production decreases with increasing ambient air temperature. The higher the ozone concentration, the bigger this effect.



The flow rate is set with the throttle valve FLOW (needle valve) in the front panel. It is also depends on the gas pressure.

**Note:** The mass flow meter measurement range is 2 NI/min (optional 5 NI/min). But he recommended max. flow rate for the BMT 803 BT is 4 NI/min.

The mass flow meter needs a warm-up of about 15 minutes and requires the BMT 803 BT to be operated in its normal orientation on a horizontal surface.

If the oxygen mass flow (g/h) is known, and the ozone content (%wt/wt) of the ozone gas produced from this oxygen (measured with the optional OZONE ANALYZER BMT 964), the ozone mass flow can be calculated. The thermal mass flow meter displays the oxygen flow in normal liters per minute (NI/min). One NI/min of oxygen equals 85.7 g/h. Now the ozone mass flow can be calculated:

Let the oxygen mass flow displayed be F [NI/min] and the ozone content be O [%wt/wt]. Now the ozone mass flow is

$$85.7 \cdot F \cdot O/100.$$

Example: F = 0.95 NI/min, O = 10.14 %wt/wt (150 g/Nm<sup>3</sup>). Now the ozone mass flow is

$$85.7 \cdot 0.95 \cdot 0.1014 = 8.26 \text{ g/h.}$$

See our TechNote TN-2 *Ozone: "Different Concentrations"* for details.

The ozone-resistant pressure gauge behind the outlet needle valve shows the ozone system counter pressure, the pressure into which the ozone gas is flowing.

## 5 Maintenance

After 35,000 hours of operation the generator has to be serviced due to the limited life of the fans.

No further preventive maintenance (PM) is needed. There are no other serviceable parts inside the BMT 803 BT.

## 6 Troubleshooting

In case the BMT 803 BT has to be sent in for service or repair, you do not need an RMA, **but please provide the following details:**

### Hazardous Material Certification:

For the protection of BMT employees we need to know about any possible hazardous contamination outside and inside of our products prior to any repair and service.

Instruments not free of such substances **may be rejected by BMT**.

Type of product:
Serial number(s):

Please describe the status of the returned instrument regarding hazardous substances below:

<input type="checkbox"/> The products have not been exposed to any hazardous substance at any time
<input type="checkbox"/> The products have been completely decontaminated and contain no residual hazardous substances
<input type="checkbox"/> The remaining contamination is not unhealthy, toxic, carcinogenic, radioactive, microbiologic, explosive, corrosive or caustic, it is harmless <b>and contains</b> (insert here):

Herewith, I certify that the products being returned to the factory are **free of any hazardous substances**, as stated above:

Undersigned:	Your Company:
Date & Signature:	

The **feed gas** used for the ozone generator is as follows:

<input type="checkbox"/> Liquid Oxygen	<input type="checkbox"/> bottled Oxygen	<input type="checkbox"/> PSA, VPSA	<input type="checkbox"/>	<input type="checkbox"/> don't know
N2 or other gas added for performance (please specify):				

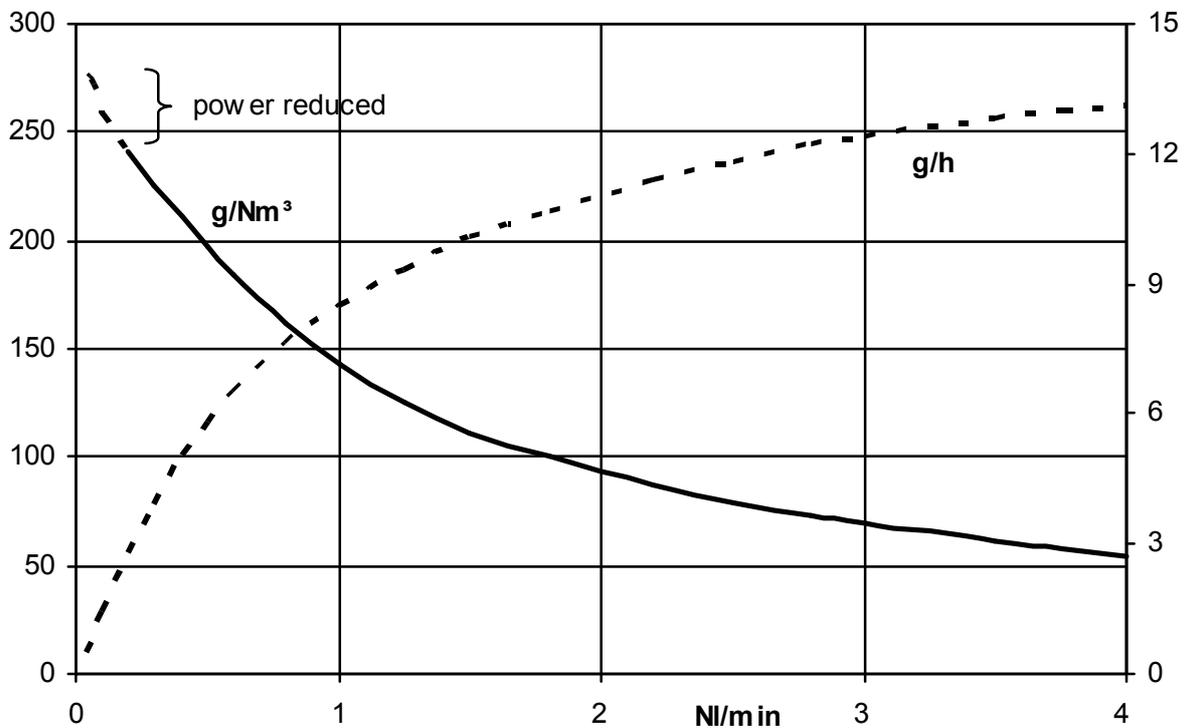
### Service: Checklist

<input type="checkbox"/> fill out and sign above Hazardous Material Certification		
by all means include in all paperwork accompanying your shipment:		
<input type="checkbox"/> your contact details: delivery & invoicing address, phone number, EMail address		
<input type="checkbox"/> serial number of the instrument		
<input type="checkbox"/> reason for return:		
<input type="checkbox"/> ship to one of the following addresses:		
BMT MESSTECHNIK GmbH Attn: Klaus Tiedemann Güterfelder Damm 87-91 D-14532 Stahnsdorf, Germany	www.bmt-berlin.de service@bmt-berlin.de Tel. +49-3329-696 77 0 Fax +49-3329-696 77 29	
<u>For North America, Central America, Pacific Rim:</u>	OSTI Inc. 99 Pacific Street, Suite 400C Monterey, CA 93940, USA	www.osti-inc.com vciufia@osti-inc.com Tel. +1-831-649-1141 Fax +1-831-649-1151

**7 Specifications**

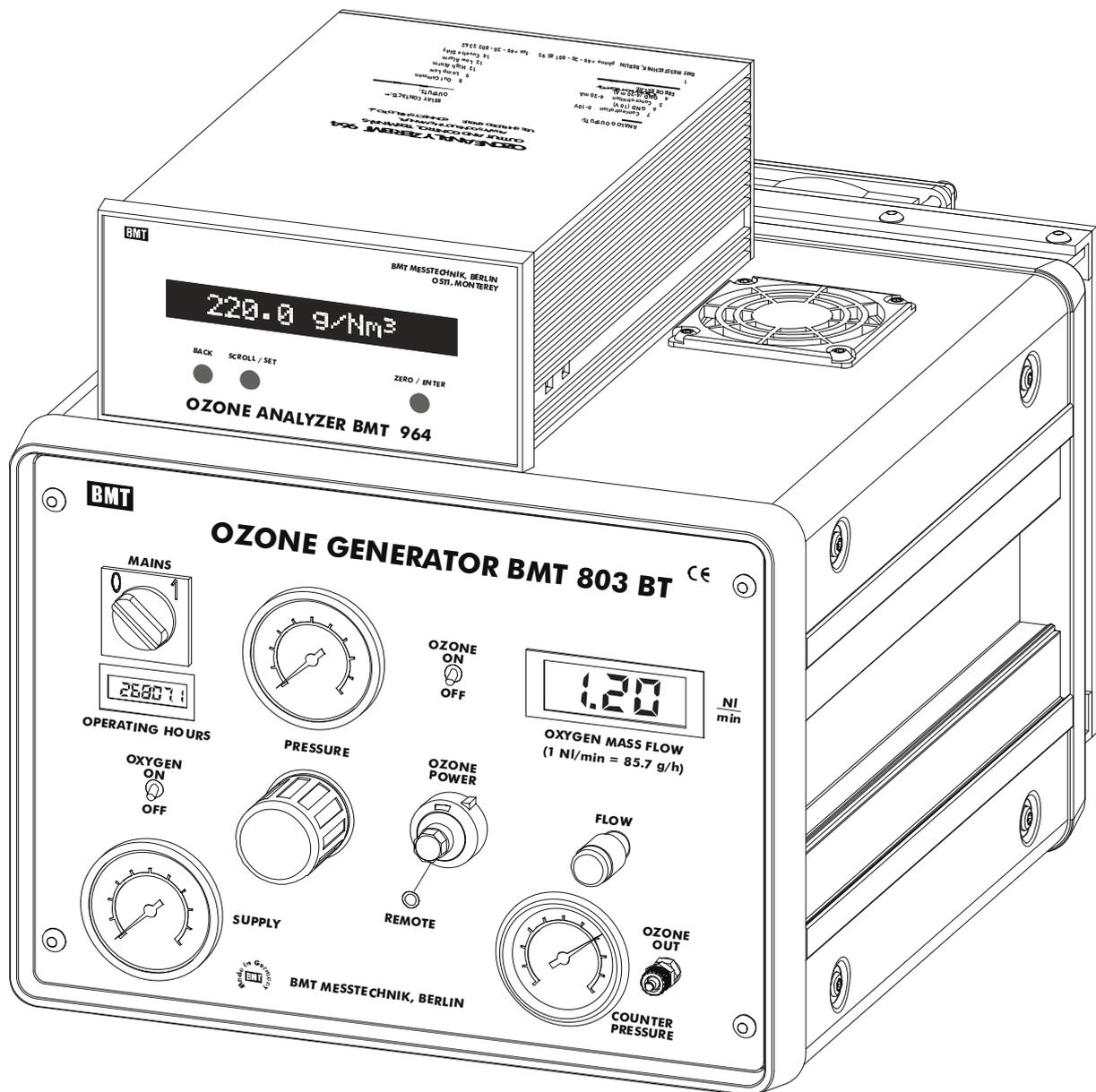
feed gas	pure oxygen
cooling	ambient air
oxygen flow rate	0.02 to 4 NI/min recommended
flow measurement	mass flow meter 0 to 2 NI/min or 0 to 5 l/min, accuracy +/- 1.5% FS
ozone production	> 8 g/h @ 100 g/Nm <sup>3</sup>
max. O <sub>3</sub> concentration	> 250 g/Nm <sup>3</sup>
adjustment range	15 to 100% ozone output at 0 to 100% control input
feed gas pressure	max. 4 barg
max. ozone gas pressure	1 barg
ambient temperature	0 to 30°C
ambient temperature effect	output decreasing by approx. 0.8% / K
gas ports	oxygen inlet: for 4x6 mm FEP (or PTFE) tubing ozone outlet: for 3x5 mm (1/8"x3/16") FEP (or PTFE) tubing two in-line ports for optional ozone analyser
power	230 or 115 VAC, 170 W, 50/60 Hz
dimensions (WxHxD)	255 x 200 x 385 mm (10" x 8" x 15")
weight	10 kg

**Typical ozone concentration and production at 1.5 bar<sub>abs</sub>  
BMT 803BT at 20°C 151W**



## 8 Appendix A: Option Ozone Analyser

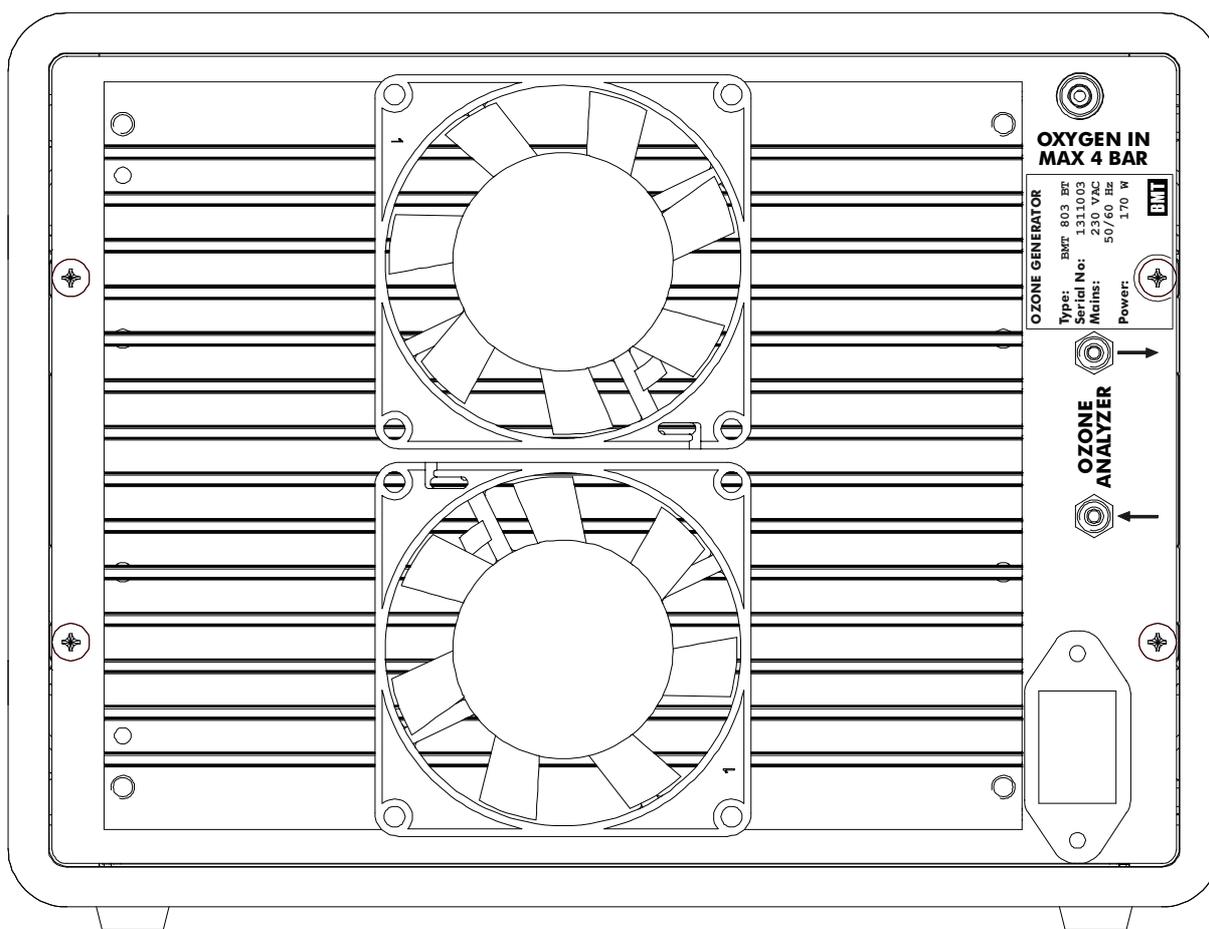
The option BMT 803 BTA adds an OZONE ANALYZER BMT 964 to the basic BMT 803 BT described above. The analyser is a modified version of the BMT 964. It has a pressure range of 2 bara and measures at the system pressure present at the outlet of the generator. It has a concentration range of 300 g/Nm<sup>3</sup> (20 %wt/wt).



There are two fittings provided at the rear of the BMT 803 BT for connecting this analyser and measure the ozone at the operating pressure of the generator cell.

Before connecting the analyser to the generator (or disconnecting the analyser) make sure there is no ozone in the BMT 803 BT and the operating pressure is equal to the ambient. This may be accomplished by first switching the off ozone generation (OZONE OFF) without switching off the whole generator, then wait for any possible ozone to be replaced by the oxygen flow, and after that switching off the BMT 803 BT using the MAINS switch.

Remove the shorting tubing from the two fittings on the rear. Connect the analyser's input to the upper fitting, and the outlet of the analyser to the lower fitting, using short (!) pieces of FEP (or PTFE) tubing.



**Caution: Never operate the generator with the fittings unconnected!** In case there is no analyser installed the two fittings in the back plane must be connected to each other with a short piece of tubing. Make sure the tubing is not kinked, as this would restrict the complete flow through the generator.

For the proper operation and the settings of the analyser please refer to the manual of the BMT 964 delivered with this generator.