



Instruction Manual

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DE-OX[®] SAFE

CARBON MONOXIDE ANALYZER

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Discharge of Liability

Before operating and installing please read this manual carefully. This manual is an integral part of the **DE-OX® SAFE** Carbon Monoxide analyzer. The use of this instrument implicates total acceptance of the present section.

All warranties relevant to this instrument are void if is not operated and maintained in accordance with this manual.

TEMCO® disclaims every responsibility for the improper, wrong or incorrect use of this measurement instrument. Before use, it is necessary to receive a proper training on mixed gas diving and gas mixtures analysis for diving applications. It is dangerous to breathe mixed gas containing Carbon Monoxide. Sport and mixed gas diving is a potentially hazardous and dangerous activity that may lead to death if practised incorrectly. Manipulating mixed gas with oxygen is dangerous and requires special training and oxygen dedicated equipment. The present instrument does not replace the necessary notional and practice training for these activities. The data displayed are a mathematical elaboration based on physical laws but they are not representative of the complexity of human physiology and of the different psycho-physical situation of use by customers.

Carbon monoxide is a colourless and odourless toxic gas, that could be yielded from engine exhalation or from bad maintained compressor filters. If breathed it bonds with blood haemoglobin affecting the oxygen transport to the body tissues. Carbon Monoxide poisoning is extremely dangerous and could be only treated with immediate medical cares and could even lead to death.

TEMCO® is not liable for any damage or injury including death which may result from **DE-OX® SAFE** utilisation.

The operator of this instrument is responsible for any damage or injury resulting from improper use, unauthorized repair, improper maintenance, or damage by anyone other than **TEMCO®**. Use always another instrument for data cross checking.

TEMCO®, whose policy is one of continuous quality improvement, reserves the right to modify the technical characteristics of the instrument and manual without prior notice.

Safety Information - Read First

Do not use the Meter as a stand alone personal safety monitor. Learn and recognize the effects of CO poisoning.

0-1 PPM	Normal background levels.
9 PPM	ASHRAE Standard 62-1989 for living areas.
50 PPM	OSHA enclosed space 8-hour average level.*
100 PPM	OSHA exposure limit.*
200 PPM	Mild headache, fatigue, nausea and dizziness.
800 PPM	Dizziness, nausea and convulsions. Death within 2 to 3 hours.

* U.S. Department of Labor, Occupational Safety & Health Administration (OSHA) Regulation 1917.24: The CO content in any enclosed space shall be maintained at not more than 50 PPM (0.005%). Remove employees from enclosed space if the CO concentration exceeds 100 PPM (0.01 %).

General Specifications

Thank you for buying the **DE-OX® SAFE** Carbon Monoxide analyzer. DE-OX® SAFE computer represents the most up-to-date measurement instrument that technology allows for the analysis of Carbon Monoxide into mixed gas. It has been especially designed and manufactured for the analysis of breathable gas mixtures like Nitrox, Heliox and Trimix.

DE-OX® SAFE comprises a central unit containing an electronic device driven by a CMOS microprocessor, one electrochemical sensor for Carbon Monoxide. This sensor gives electrical signals with the gases percentage in the mixed gas. On the central unit's display, these signals are transformed in easy-to-read information given in real time.

It is also possible to show and read further information.

Main features:

- Carbon Monoxide analysis into the gas mix.
- 0-100 ppm (parts per million) measurement range.
- 1 ppm resolution
- Sensor and analyzer autosetting.
- Ambient temperature in °C.
- Electrochemical sensor with no needs of periodical calibration.
- Two custom audible and visible alarms.
- Analog 4-20 mA output for external devices.
- Numeric display of 50x35mm.
- Battery low indicator.
- Standard 9 Volt transistor battery.
- Simple battery and sensor replacement.
- Direct connection to every kind of tank valve with **TEMCC®** rubber cup.
- Soft protection and transport bag.
- Dimensions: max 7,5x4,2 cm weight 250 grams.



Powering On and Warming Up

Press the On Off key for more than one second, until the display shows "On", After that the "Att" (WAIT) message will be displayed for about 3 seconds.

Reading Page

At the end of the warming up time, the instrument is now ready to read ppm (parts per million) concentration of Carbon Monoxide into the gas mix.

Connect the sensors to the mixed gas flow with a flow of 0,5-1,0 litres/minute at ambient pressure (typically 1 bar) and temperature (typically 20°C). Now on the display the Carbon Monoxide content (if any) will be continuously displayed.

While the instrument is in reading page, keeping the <Calib key pressed for more than 1 seconds causes the device to blinking display the Temperature in °C.

Warning

During gas analysis the instrument and the sensors must be firmly kept and must not be shaken. The gas pipe used to provide gas mix to the sensor must allow free gas flowing.

Warning

The mixed gas flow, must be 0,5 litres/min at ambient pressure (typically 1 bar) and temperature (typically 20°C) or DE-OX® SAFE will yield a wrong gas analysis. All the analysis concentration shown on the display will be wrong. Wrong Carbon Monoxide analysis may lead to death.

Programming Procedures

Keep the ^ Prog key pressed for more than two seconds, then release the key. On the display will appear "Pr" for two second in order to advice the start of the programming procedure. It is possible to program:

- AL1 First alarm threshold expressed in ppm of Carbon Monoxide concentration
- AL2 Second alarm threshold expressed in ppm of Carbon Monoxide concentration

- FSc Value expressed in ppm of Carbon Monoxide concentration corresponding to the current output full scale value (20mA). 4mA always correspond to zero ppm CO concentration.
- nA Conversion value of Carbon Monoxide sensor
- Fct Gain factor

At the end of the of the programming procedure on the display will be displayed “End” and the instrument will display the Carbon Monoxide content in the gas mix.

Threshold Alarms Setting

Press the ^ Prog key for more than two seconds, then release the key. On the display will appear “Pr” for two second in order to advice the start of the programming procedure. Then will appear “AL1” for changing the value of the first alarm threshold. The display will show “AL1” and the value of the alarm threshold alternatively. The blinking digit shows the current cursor position.

Press the ^ Prog key for increasing the value (from 0 to 9).

Press the <Calib key to move the cursor to the next digit.

Press the On Off key for accepting the value and jumping to AL2 threshold programming page.

Act as for AL1 to modify the AL2 threshold to the desired value.

Full Scale Value Setting

Once the alarms thresholds setting, the instrument goes to “Fsc” page in order to change the analogue full scale value of the instrument. This is the Carbon Monoxide concentration corresponding to 20 mA on the analogical output. 4 mA is the value at 0 ppm of Carbon Monoxide.

The message “Fsc” and the analogue output full scale value will be displayed alternatively.

The blinking digit shows the current cursor position.

Press the ^ Prog key for increasing the value (from 0 to 9).

Press the <Calib key to move the cursor to the next digit.

Press the On Off key for accepting the value and jumping to the next program page “nA”.

Conversion Value of Carbon Monoxide Sensor

After the “Fsc” the instrument goes to “nA”, that is the conversion value of the Carbon Monoxide sensor in nano Ampere. It is not necessary to modify this value except when it is installed a new sensor. The new sensor will be provided with the new value to be set in this page. It is displayed alternatively “nA” and the value of the full scale. The blinking digit shows the current cursor position.

Press the ^ Prog key for increasing the value (from 0 to 9).

Press the <Calib key to move the cursor to the next digit.

Press the On Off key for accepting the value and jumping to the next program page “Fct”.

With this procedure it is not necessary to send back the instrument to the TEMC[®] factory when a new sensor should be installed.

Warning

The conversion value of the Carbon Monoxide sensor is set in factory and must be changed only when the CO sensor is replaced. The new sensor will come from the factory with a label showing the new ‘nA’ value to be programmed. A wrong value of this parameter will give a wrong reading of CO concentration. If is modified the conversion value of the Carbon Monoxide sensor, the instrument will be no more accurate. All the analysis concentration shown on the display will be wrong. Do not modify this value. It is necessary to modify this value only at the installation of a new sensor. Wrong Carbon Monoxide analysis may lead to death.

Gain Factor

After the “nA” the instrument goes to “Fct”, that is the conversion value of gain factor. It is not necessary to modify this value except when it is installed a new sensor. The new sensor will be provided with the new value to be set in this page. It is displayed alternatively “Fct” and the value of the full scale. The blinking digit shows the current cursor position.

Press the ^ Prog key for increasing the value (from 0 to 9).

Press the <Calib key to move the cursor to the next digit.

Press the On Off key for accepting the value and ending the programming procedures. On the display will appear for two seconds "End", then the instrument will show the ppm Carbon Monoxide reading. With this procedure it is not necessary to send back the instrument to the TEMC[®] factory when a new sensor should be installed.

Warning

The gain factor is set in factory and must be changed only when the CO sensor is replaced. The new sensor will come from the factory with a label showing the new 'Fct' value to be programmed. A wrong value of this parameter will give a wrong reading of CO concentration. If is modified the gain factor, the instrument will be no more accurate. All the analysis concentration shown on the display will be wrong. Do not modify this value. It is necessary to modify this value only at the installation of a new sensor. Wrong Carbon Monoxide analysis may lead to death.

Threshold Alarms

Should the Carbon Monoxide reading goes over the threshold alarms (AL1 or AL2) the instrument goes to alarm mode and it activates the relays output (open collector max 100mA) and the internal buzzer. On the display will be shown the trespassed alarm and the actual measured value. For stopping the buzzer song it is enough to press any key. In this event the instrument will remain in alarm mode until the analysed value will go below the alarm.

Powering Off

For powering off the instrument, in the reading page press the On Off key for more than 1 second. On the display will appear "Off" and the instrument will power off.

Factory Reset

In case it is necessary to reset the instrument to the factory settings, power on the instrument pressing at the same time for more than one second the On Off and the <Calib keys. On the display will appear "res" and the instrument will go to the reading page.

Warning

In case of reset, the instrument will delete all the alarms settings, the full scale value, any new conversion value of Carbon Monoxide sensor and of the gain factor. Before using again the instrument, it may be necessary to program again the alarm values, the full scale value, the conversion value of Carbon Monoxide sensor and gain factor if changed. All the analysis concentration shown on the display would be wrong. Wrong Carbon Monoxide analysis may lead to death.

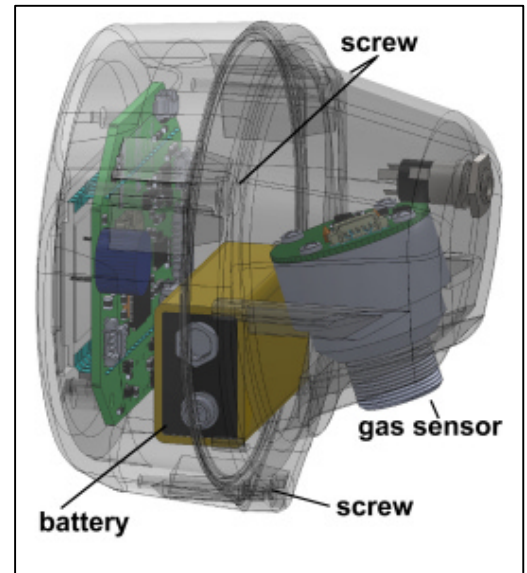
Note For Correct Carbon Monoxide Analysis

Install the pipe to the flow adapter of the sensors.
During the gas analysis, the unit must be kept steady and must not be shaken or submitted to vibrations. Allow gas freely flows into the pipes.
The mixed gas flow that comes in contact with the sensors, must range from 0,5 to 1 litres/min (best 0,5 lit/min) at ambient pressure (typically 1 bar) and temperature (Typically 20°C), or a wrong gas analysis will occur (preferably use a flow regulator with meter connected to the mixed gas tank not included).
Higher flow value or pressure or temperature variations, will cause wrong analysis and may damage the sensor.
It is possible to let **DE-OX[®] SAFE** in ambient for ambient analysis of Carbon Monoxide. In this case the reading will be slower (up to 5 minutes).

Replacement of the Battery and of the Carbon Monoxide Sensor

DE-OX[®] SAFE requires one 9 Volt transistor alkaline battery. It must be replaced when "bat" appears on the display. To replace the battery:
- Switch off **DE-OX[®] SAFE**.

- Remove the three closing screws and carefully open the instrument.
- Remove the old battery and replace it with the new one.
- Do not throw anyway the old battery. Check the correct recycling procedure.
- Close the instrument screwing the three closing screws.
- Switch on the instrument with the On-Off key and check the battery level.



Warning

Don't leave battery inside the instrument if you do not use it for a long time.

The Carbon Monoxide sensor must be replaced when unable to correctly read Carbon Monoxide concentration. The sensor life is about 12-24 months or more under normal operating conditions.

Warning

Replace the Carbon Monoxide sensor when the unit is unable to correctly analyze gas. The use of an exhausted sensors may cause dangerous analysis and lead to death. Wrong Carbon Monoxide analysis may lead to death.

To replace the Carbon Monoxide sensor:

- Switch off **DE-OX® SAFE** with the On-Off key.
- Remove the three closing screws and carefully open the instrument.
- Unscrew the old sensor.
- Remove the old sensor screwing un-clockwise and replace it with the new one.
- Connect again the sensor wires.
- Do not throw anyway the old sensor. Check the correct recycling procedure.
- Close the instrument screwing the three closing screws.
- Switch on the instrument with the On-Off key and check the unit.
- Change the Conversion Value of Carbon Monoxide sensor and the conversion value of the gain factor into the programming page.

Warning

Do not try to disassemble the sensor. Sealed unit contains caustic liquid which can cause severe burns to skin and eyes. In case of contact, flush 15 minutes with water. For contact to eyes also get medical attention.

Warning

The conversion value of the Carbon Monoxide sensor and of the gain factor is set in factory and must be changed only when the CO sensor is replaced. The new sensor will come from the factory with a label showing the new 'nA' and 'Fct' values to be programmed. A wrong value of these parameters will give a wrong reading of CO concentration. If is modified the conversion value of the Carbon Monoxide sensor and the gain factor value, the instrument will be no more accurate. All the analysis concentration shown on the display will be wrong. Do not modify these values. It is necessary to modify this value only at the installation of a new sensor. Wrong Carbon Monoxide analysis may lead to death.

Central Unit Specifications

DE-OX® SAFE contains delicate electronic devices, hence it is absolutely necessary to:

- Avoid shock (greater than 2g) or vibrations.
- Avoid exposure to environmental temperature higher than 40°C (104 F) and lower than 5°C (41 F).

- Do not supply the instrument with voltage higher than 9 V DC. This will lead to damaging the internal electronic carts.
- Press the keys delicately with your fingers and don't use any kind of tools.
- Avoid exposure to spray liquids and to corrosive gas, don't submerge and do not expose to water splash.
- For cleaning, use a soft dry brush not soaked with any liquid.
- Don't try to remove screws from DE-OX® SAFE or to open it. For any problem call TEMC®.
- Dimensions: max 7,5x4,2 cm weight 250 grams ca.

Carbon Monoxide Sensor Specifications

- Operating Principle: 2-electrode electrochemical
- Measurement Range: 0-100 ppm
- Expected Operating Life*: >2 years in normal use from date of manufacture
- Temperature Range* Continuous: -10°C to +50°C Intermittent: -20°C to +50°C
- Pressure Range*: 1 atm +10%
- Humidity Range* (non-condensing): Continuous: 15 - 90% Intermittent: 0 - 99%
- Response Time: (T5 90) <50 seconds over complete temperature range
- Baseline Offset (clean air): <-2 to 4 ppm equivalent
- Zero Shift* (-10°C to +50°C): <+10 ppm
- Long Term Output Drift: <5% per annum
- Repeatability: <+5%
- Linearity Linearity: <+5%
- Orientation: Any
- All measurements were taken at 20°C and 505 rH at 1 atmosphere pressure unless otherwise indicated. The performance data detailed in this document refer to new sensors
- With the exception of items marked * the parameters have been verified under the UL component recognition programme

Cross Sensitivity Table

Gas	Concentration Used (ppm)	Exposure Time (Minutes)	Reading (ppm CO)
Carbon Monoxide	100	5	100
Hydrogen Sulphide	25	5	0
Sulfur Dioxide	50	600	<0.5
Nitrogen Dioxide	50	900	-1.0
Nitric Oxide	50	5	8
Chlorine	2	5	0
Hydrogen	100	5	20
Carbon Dioxide	5000	5	0
Ammonia	100	5	0
Ethanol	2000	30	5
Iso-Propanol	200	120	0
Acetone	1000	5	0
Acetylene	40	5	80

In the interest of product improvement, **TEMC®** reserves the right to alter design features and specifications without notice. Check **TEMC®** for the latest sensor specifications.

Unless otherwise stated, all product specifications are quoted at standard temperature and pressure.

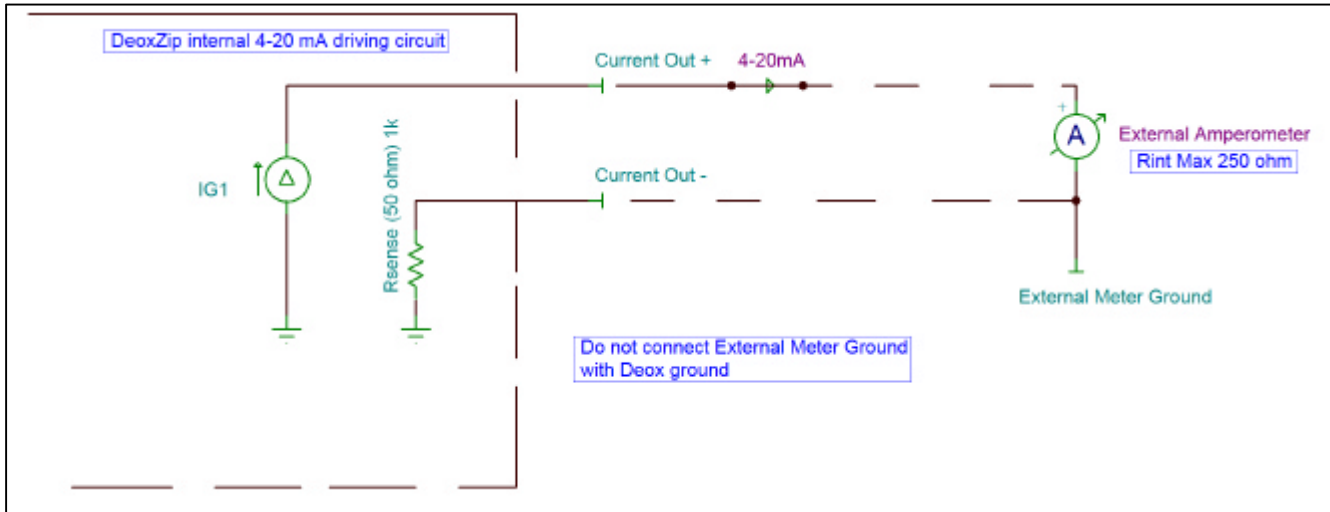
*Note: The figures in this table are typical values and should not be used as a basis for cross calibration. Cross sensitivities may not be linear and should not be scaled. For some cross interferences breakthrough will occur if gas is applied for a longer time period.

Warning

Do not try to disassemble the sensor. Sealed unit contains caustic liquid which may cause severe burns to skin and eyes. In case of contact, flush 15 minutes with water. For contact to eyes also get medical attention. Do not wet in any case.

4-20mA Connections

In the rear of the instrument there is a jack for the 4-20 mA output. Insert the plug into the jack for taking out the signal. For connections refer to the following diagram.

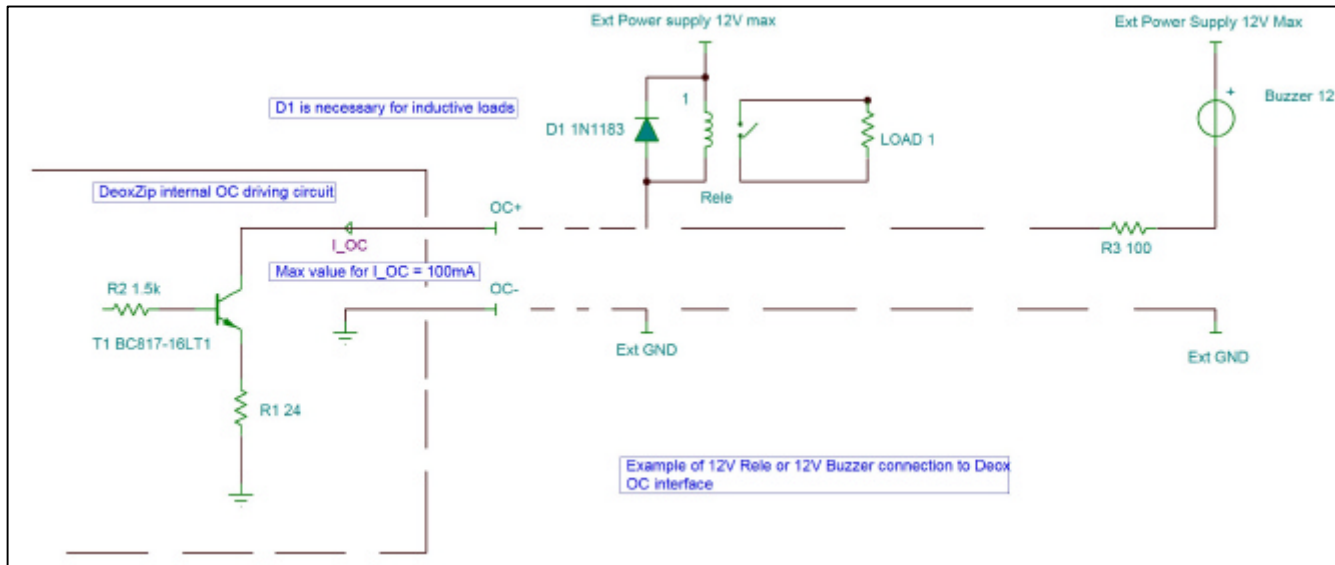


Warning

The plug should be connected or disconnected when the instrument is switched off, or the instrument will autonomously switch off.

Open Collector Connections

In the rear of the instrument there is a jack for the open collector output. Insert the plug into the jack for taking out the signal. For connections refer to the following diagram.



Warning

The plug should be connected or disconnected when the instrument is switched off, or the instrument will autonomously switch off.

Warranty

TEMIC[®] warrants that its **DE-OX**[®] **SAFE** computer will be free from defects on material and workmanship for a period of twelve (12) months from the date of delivery, with the exception of sensor that is not manufactured in-house and that is warranted for six (6) months, provided that the warranty Registration Card is filled in and returned to **TEMIC**[®] at the time of delivery.

Warranty will be void by failure to install, use or maintain **DE-OX**[®] **SAFE** according to **TEMIC**[®] instructions. To avail oneself of the warranty, send the product with carriage prepaid to **TEMIC**[®].

THESE WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR LEGAL. **TEMIC**[®] MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. Buyer's exclusive remedy shall be the replacement of any **DE-OX**[®] **SAFE** Carbon Monoxide analyzer or sensor therefore that fails to comply with the above warranty. Under no circumstances will **TEMIC**[®] be liable for economic, special, incidental or consequential damages of any kind whatsoever.

This warranty does not cover any damage due to accidental events (ex. impact or falls) or natural events (ex. fires calamities, earthquakes, etc.).

Cartolina di Garanzia (Warranty Registration Card)

Compilare e inviare in busta chiusa entro 5 giorni dall'acquisto a:
(Fill with required data and send in a sealed envelope within 5 days from purchase to):

TEMIC®

Via Donna Prassede 5 A
I-20142 MILANO ITALY
Phone +39 02 8463648 or +39 080 4490264
E-Mail: temc@iol.it Website: www.temc.it

Nome _____ Cognome _____
(First name) (Family name)
Via _____ n _____
(Address) (#)
Città _____ CAP _____
(Town) (ZIP)
Nazione _____
(Country)
Telefono _____
(Telephon)
E-Mail _____
(E-Mail)
N.serie strumento _____
(Instrument Serial number)
Data Acquisto _____
(Purchase date)

Dichiaro di aver letto e compreso il manuale di istruzione e di accettare le condizioni di garanzia del presente strumento.

(I have read and well understood the instruction manual and I accept all warranty terms).

Data _____

(Date)

Firma _____

(Signature)