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# User's Guide

## TG Series

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***Beaverton, OR 97008***

# 154-0031-0C

<b>Rev.</b>	<b>Release Date</b>	<b>By</b>	<b>Description of Change</b>	<b>ECR</b>
0A	4/14/2016	CKB	Initial Release	---
0B	3/7/2017	CKB	Updated for RS485 version.	---
0C	9/12/2017	CKB	Added "Periodic Test and Maintenance" section	---

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## References:

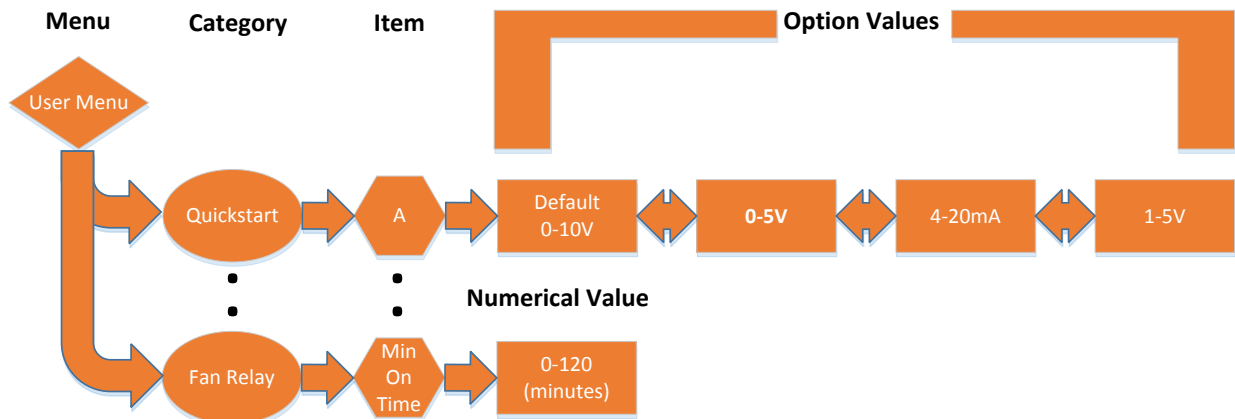
152-0270	TG Series Analog Installation Instructions
152-0271	TG Series RS485 Installation Instructions
152-0272	TG Series Hose Barb Installation Instructions
152-0273	TG Sensor Replacement Instructions
154-0032	BACnet Protocol Guide
154-0033	Modbus Protocol Guide

# General Overview

The TG product contains 3 menu systems:

- **User Menu** – Configure system functions setpoints, such as relay setpoints and analog output scaling.
- **Setup Menu** – Add/Remove sensors, and view sensor information.
- **Testing Menu** – Test functionality of system interfaces, such as relays and analog output signals.

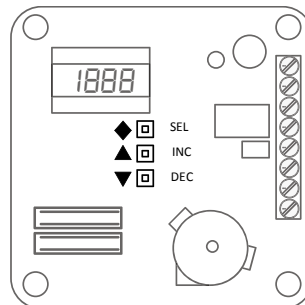
Each menu is composed of a hierarchy of primitive elements: *Categories*, *Items*, *Numerical Values*, and *Option Values*. *Categories* give you access to *Items*, which may contain either *Numerical Values* when the setting is numerical, or *Option Values* when the setting is multiple choice. A list of available *Categories* is shown at the top of each menu in this document. See *Figure 1* below for an example.



**Figure 1:** The “Quickstart” category contains an Item ‘A’, which has a set of multiple choice option values. The “Fan Relay” category has an Item ‘Min On Time’ (17.1) which can be set to any Numerical Value between 0-120 in minutes.

## Buttons

- ◆ – “Select” button.
- ▲ – “Inc” button (Increment).
- ▼ – “Dec” button (Decrement).



## Navigation and Selection

- Pressing ▲ or ▼ while viewing a Category/Item advances to the next or previous Category/Item.
- Pressing ▲ or ▼ while viewing a Numerical Value increments or decrements the value.
- Pressing ▲ or ▼ while viewing an Option Value scrolls through the available options.
- Pressing ◆ while viewing a Category allows you to view the items it contains.
- Pressing ◆ while viewing an Item allows you to view and modify the Values/Options for that Item.
- Pressing ◆ while viewing a Value/Option applies your selection and returns you to the Item view.
- Hold ▲, ▼, and ◆ for 1 second while the alarm buzzer is active to suppress the alarm.
- Each Menu contains an **ESC** Item, which will exit the current menu.
- Each Category contains an **ESC** Item, which will return you to the previous Menu screen.

*\*Unless otherwise specified, all changes to Numerical Values/Option Values occur at the time ▲ or ▼ is pressed.*

# User Menu

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Access the User Menu by pressing the **◆** button for one second. The User Menu organizes settings into several categories. Many of these settings can also be modified over BACnet or Modbus. The object/instance number is noted in each modifiable value. See the relevant protocol guide for more information.

## **Categories**

- **Quickstart (95EAPL)**  
Allows the user to select from a list of pre-defined configurations for quick and easy startup.
- **Analog Output Channel 1 (OUT\_1)**  
Contains all of the settings which control the output signal on channel 1. (*Analog Version only*)
- **Analog Output Channel 2 (OUT\_2)**  
Contains all of the settings which control the output signal on channel 2. (*Analog Version only*)
- **RS485 (R54B5)**  
Manually set the RS485 communication settings. (*RS485 Version only*)
- **CO Setpoints (CO\_SETE INGS)**  
Contains all of the user configurable setpoints, which control the system response to the CO Gas Sensor. (*CO Sensor only*)
- **NO<sub>2</sub> Setpoints (NO2\_SETE INGS)**  
Contains all of the user configurable setpoints, which control the system response to the NO<sub>2</sub> Gas Sensor. (*NO<sub>2</sub> Sensor only*)
- **Temperature Setpoints (PFC\_SETE INGS)**  
Contains all of the user configurable setpoints, as well as unit selection, which control the system response to the thermistor.
- **Fan Relay (FAN\_RELAY)**  
Configure the timing of the fan relay (warning relay).
- **Alarm Relay (ALP\_RELAY)**  
Configure the timing of the alarm relay. (*Analog Version only*)
- **Buzzer (BUZZER)**  
Configure the timing of the alarm buzzer.
- **Display (DI\_SPLAY)**  
Customize the performance of the display.

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# 95tARt

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A

Applies the following setpoints to their respective sensors:

**CO Warning = 25, CO Alarm = 100, NO2 Warning = 1, NO2 Alarm = 3 (in PPM), Buzzer Delay = 30 (minutes).**

10V 0-10V Output Range (**Default**)

1.5 1-5V Output Range (Analog Version Only)

420 4-20mA Output Range (Analog Version Only)

0.5 0-5V Output Range (Analog Version Only)

B

Applies the following setpoints to their respective sensors:

**CO Warning = 15, CO Alarm = 50, NO2 Warning = 0.7, NO2 Alarm = 2 (in PPM), Buzzer Delay = 30 (minutes).**

10V 0-10V Output Range

1.5 1-5V Output Range (Analog Version Only)

420 4-20mA Output Range (Analog Version Only)

0.5 0-5V Output Range (Analog Version Only)

C

Applies the following setpoints to their respective sensors:

**CO Warning = 35, CO Alarm = 100, NO2 Warning = 1, NO2 Alarm = 5 (in PPM), Buzzer Delay = 30 (minutes).**

10V 0-10V Output Range

1.5 1-5V Output Range (Analog Version Only)

420 4-20mA Output Range (Analog Version Only)

0.5 0-5V Output Range (Analog Version Only)

t5t

Applies the following setpoints to their respective sensors:

**CO Warning = 5, CO Alarm = 10, NO2 Warning = 0.5, NO2 Alarm = 1 (in PPM), Buzzer Delay = 2 (minutes).**

10V 0-10V Output Range

1.5 1-5V Output Range (Analog Version Only)

420 4-20mA Output Range (Analog Version Only)

0.5 0-5V Output Range (Analog Version Only)

ESC

Returns to the User Menu screen.

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# OUT\_1 / OUT\_2

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U\_C

Selects the output mode of the analog output signals. Changing this setting on either *OUT\_1* or *OUT\_2* sets the output mode on both analog output channels.

UOL Voltage Out (Default)

CUP Current Out

**SEN** Selects the sensor to be output on output channel 1 (*OUT\_1*) or output channel 2 (*OUT\_2*). By default, if a single sensor is present it will be configured on output channel 1. If two sensors are present, CO will default to output channel 1, while the NO2 sensor will default to output channel 2.

**NON** No sensor selected.

**CO** CO Gas.

**NO2** NO2 Gas.

**°FC** Temperature.

**UH1** Sets the voltage corresponding to the maximum sensor reading, 0-10 Volts.  
Default: 10 Volts

**ULO** Sets the voltage corresponding to the minimum sensor reading, 0-10 Volts.  
Default: 0 Volts

**CH1** Sets the current corresponding to the maximum sensor reading, 4-20 Milliamps.  
Default: 20 Milliamps

**CLO** Sets the current corresponding to the minimum sensor reading, 4-20 Milliamps.  
Default: 4 Milliamps

**ESC** Returns to the User Menu screen.

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# RS485

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**Adr** Sets the RS485 address. The full address range 0-254 is supported. When at address 255, this is considered "AUTO ADDRESSING" mode (see *TG BACnet/Modbus Protocol Guides*), and will show up as "???" on the LCD display if an automatic address has not been detected and configured. Once an address has been selected in auto mode, the address will show up in this field along with an "O/R" symbol in the bottom center of the LCD to indicate this address was automatically selected by the TG.

*RS485 Version Only: AV123 (BACnet), R123 (Modbus).*

Default: ?? (Auto Mode)

**id.1** Sets the Ones digit of the device id. The max device id is 4,194,302  
If the combination of id.1 and id.2 exceed 194,302, then the max value that may be set in the id.3 field is 3.

Example: To set the device id to 1,234,567 each id field should be as follows  $\frac{1}{id.3} \frac{234}{id.2} \frac{567}{id.1}$

Default: Varies

**id.2** Sets the Thousands digit of the device id. See *id.1*.  
Default: 665

**id.3** Sets the Millions digit of the device id. See *id.1*.  
Default: 0

**br** Sets the RS485 baud rate.  
*RS485 Version Only: AV124 (BACnet), R124 (Modbus).*

**Aut** Auto Baud Rate (Default)

**96** 9600 Baud

**192** 19,200 Baud

**288** 28,800 Baud

**384** 38,400 Baud

**576** 57,600 Baud

**768** 76,800 Baud

**115** 115,200 Baud

**230** 230,400 Baud

**460** 460,800 Baud

**Pro** Sets the RS485 protocol.

*RS485 Version Only: MSV122 (BACnet), R122 (Modbus).*

**Aut** Auto Protocol (Default)

**bAC** BACnet

**ASC** Modbus ASCII

**RTU** Modbus RTU

**PAR** Sets the RS485 parity.  
*RS485 Version Only: MSV126 (BACnet), R126 (Modbus).*

<b>Aut</b>	Auto Parity (Default)
<b>NON</b>	No Parity
<b>Odd</b>	Odd Parity
<b>EUN</b>	Even Parity

**db** Sets the RS485 data bits.  
*RS485 Version Only: R127 (Modbus accessible only).*

<b>Aut</b>	Auto Data Bits (Default)
<b>7</b>	7 Data Bits
<b>8</b>	8 Data Bits

**sb** Sets the RS485 stop bits.  
*RS485 Version Only: R128 (Modbus accessible only).*

<b>Aut</b>	Auto Stop Bits (Default)
<b>1</b>	Stop Bit
<b>1.5</b>	1.5 Stop Bits
<b>2</b>	2 Stop Bits

**ESC** Returns to the User Menu screen.

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## CO-SETPOINTINGS

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**SPH** Sets the alarm setpoint level in PPM. Accepts any value between 0-1000 in whole PPM.  
*RS485 Version Only: AV152 (BACnet), R152 (Modbus).*  
Default: 100 PPM

**SPL** Sets the warning setpoint level in PPM. Accepts any value between 0-1000 in whole PPM.  
*RS485 Version Only: AV150 (BACnet), R150 (Modbus).*  
Default: 25 PPM

**HYS** Sets the setpoint hysteresis, in PPM. The setpoint hysteresis defines how far below the Warning/Alarm setpoint the sensor value must drop before changing state from Alarm to Warning or Warning to Normal.  
*RS485 Version Only: AV154 (BACnet), R154 (Modbus).*  
Default: 0 PPM



**PGH** Sets the value in PPM which corresponds to the maximum analog output signal range. Accepts any value between 0-1000 in whole PPM. (Analog Version Only)  
Default: 200 PPM

**PNL** Sets the value in PPM which corresponds to the minimum analog output signal range. Accepts any value between 0-1000 in whole PPM. (Analog Version Only)  
Default: 0 PPM

**ESC** Returns to the User Menu screen.

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## NO2\_SETTINGS

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**SPH** Sets the alarm setpoint level in PPM. Accepts any value between 0-20 in whole PPM.  
*RS485 Version Only: AV162 (BACnet), R162 (Modbus).*  
Default: 3 PPM

**SPL** Sets the warning setpoint level in PPM. Accepts any value between 0-20 in whole PPM.  
*RS485 Version Only: AV160 (BACnet), R160 (Modbus).*  
Default: 1 PPM

**HYS** Sets the setpoint hysteresis, in PPM. The setpoint hysteresis defines how far below the Warning/Alarm setpoint the sensor value must drop before changing state from Alarm to Warning or Warning to Normal.  
*RS485 Version Only: AV164 (BACnet), R164 (Modbus).*  
Default: 0 PPM

**PGH** Sets the value in PPM which corresponds to the maximum analog output signal range. Accepts any value between 0-20 in whole PPM. (Analog Version Only)  
Default: 10 PPM

**PNL** Sets the value in PPM which corresponds to the minimum analog output signal range. Accepts any value between 0-20 in whole PPM. (Analog Version Only)  
Default: 0 PPM

**ESC** Returns to the User Menu screen.

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## OFF\_SETTINGS

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**FC** Selects the temperature display units.  
*RS485 Version Only: MSV133 (BACnet), R133 (Modbus).*

- °C Degrees Celsius
- °F Degrees Fahrenheit (Default)

**PGH** Sets the value which corresponds to the maximum analog output signal range. Accepts any value between -20°C (-4°F) and 85°C (185°F) in whole degrees. (Analog Version Only)  
Default: 140 °F

**PNL** Sets the value which corresponds to the minimum analog output signal range. Accepts any value between -20°C (-4°F) and 85°C (185°F) in whole degrees. (Analog Version Only)  
Default: 14 °F

**ESC** Returns to the User Menu screen.

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## FAN\_RELAY

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**NEL** Sets the minimum time, in minutes, which the relay must be active before it can turn off. Accepts any value between 0-120 in whole minutes.  
*RS485 Version Only: BO210 minimum on time (BACnet), R214 (Modbus).*  
Default: 1 Minute

**FEL** Sets the minimum time, in minutes, which the relay must be inactive before it can turn on. Accepts any value between 0-120 in whole minutes.  
*RS485 Version Only: BO210 minimum off time (BACnet), R216 (Modbus).*  
Default: 1 Minute

**FLH** Sets the maximum time, in minutes, which the relay can be inactive. Accepts any value between 0-1440 in whole minutes. If set to '0' the maximum off time will be infinite.  
*RS485 Version Only: AV212 (BACnet), R212 (Modbus).*  
Default: 0 Minutes

**ESC** Returns to the User Menu screen.

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## ALP\_RELAY

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**NEL** Sets the minimum time, in minutes, which the relay must be active before it can turn off. Accepts any value between 0-120 in whole minutes.  
Default: 1 Minute

**FEL** Sets the minimum time, in minutes, which the relay must be inactive before it can turn on. Accepts any value between 0-120 in whole minutes.  
Default: 1 Minute

**FELH** Sets the maximum time, in minutes, which the relay can be inactive. Accepts any value between 0-1440 in whole minutes. If set to '0' the maximum off time will be infinite.  
Default: 0 Minutes

**ESC** Returns to the User Menu screen.

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## BUZZER

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**NEL** Sets the minimum time, in minutes, which the buzzer must be active before it can turn off. Accepts any value between 0-120 in whole minutes.  
*RS485 Version Only: BO230 minimum on time (BACnet), R234 (Modbus).*  
Default: 0 Minutes

**FEL** Sets the minimum time, in minutes, which the buzzer must be inactive before it can turn on. Accepts any value between 0-120 in whole minutes.  
*RS485 Version Only: BO230 minimum off time (BACnet), R236 (Modbus).*  
Default: 0 Minutes

**DEL** Sets the time delay, in minutes, before the buzzer activates once its activation setpoint has been reached. Accepts any value between 0-60 in whole minutes.  
*RS485 Version Only: AV232 (BACnet), R232 (Modbus).*  
Default: 30 Minutes

**ESC** Returns to the User Menu screen.

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# d ISPLAY

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**SRC** Sets the sensor values to be displayed in Idle mode. After all user selected sources have been displayed, if any pertinent conditions exist in the system they will be shown in the form of a condition code. (See Idle Condition Codes section)

**WARNING:** The internal air temperature may vary from outside air due to self-heating of the device.

- cn** CO, NO2, and Temperature. (CO and NO2 sensors must be installed)
- c** CO. (CO sensor must be installed)
- n** NO2. (NO2 sensor must be installed)
- t** Temperature.
- cn** CO, NO2. (CO and NO2 sensors must be installed)
- c t** CO, Temperature. (CO sensor must be installed)
- nt** NO2, Temperature. (NO2 sensor must be installed)
- OFF** Blank display.

**CON** Sets the contrast of the display. The higher the value of the contrast, the darker the lettering on the screen will be. Accepts any integer value from 50-100.

Default: 75

**ITVU** Sets the amount of time, in seconds, that a value in the Idle menu is displayed before automatically moving to the next value. Accepts any integer value from 1-10 seconds.

Default: 10 Seconds

**ESC** Returns to the User Menu screen.

# Setup Menu

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Access this menu by pressing the **◆** and **▲** buttons simultaneously for one second. The settings menu is organized into several categories.

## **Categories**

- **CO (CO):** Allows the user to view information about the CO sensor (nA/PPM, and sensor lifetime left in days), as well as add/remove the sensor and set a 0 PPM point.
- **NO2 (NO2):** Allows the user to view information about the NO2 sensor (nA/PPM, and sensor lifetime left in days), as well as add/remove the sensor and set a 0 PPM point.
- **Reset (RSE):** Resets the device configuration to its factory default settings.

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## CO

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Add

Adds a CO sensor to the TG. If a CO sensor is already installed its nA and EOL values will be overwritten with default values after being added. (See *Sensor Replacement Instructions*)

nA

Sets the nanoamp per PPM setting for the CO sensor. This value must be set manually after adding a sensor. If the new value is 4 or more digits long round it to 3 digits. Example: 23.45 will become 23.5. (See *Sensor Replacement Instructions*)

EOL

View the number of days remaining in the CO sensor's lifespan. This value can be used to verify whether a sensor needs to be replaced in the near future.

ZEP

Sets the present sensor reading as the sensor's zero point. This should only be used in an environment where the user is sure there is zero CO gas present.

CLZ

Clears the present zero setting of the device for the CO sensor.

RUE

Removes the installed CO sensor from the TG. This item is only visible if a CO sensor is presently installed. Confirmation is required to remove a sensor. (See *Sensor Replacement Instructions*)

ESC

Exits back to the main Setup Menu screen.

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## NO2

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**Add** Adds a NO2 sensor to the TG. If a NO2 sensor is already installed its *NA* and *EOL* values will be overwritten with default values after being added. (See *Sensor Replacement Instructions*)

**NA** Sets the nanoamp per PPM setting for the NO2 sensor. This value must be set manually after adding a sensor. If the new value is 4 or more digits long round it to 3 digits. Example: 23.45 will become 23.5. (See *Sensor Replacement Instructions*)

**EOL** View the number of days remaining in the NO2 sensor's lifespan. This value can be used to verify whether a sensor needs to be replaced in the near future.

**ZEP** Sets the present sensor reading as the sensor's zero point. This should only be used in an environment where the user is sure there is zero NO2 gas present.

**CLZ** Clears the present zero setting of the device for the NO2 sensor.

**RMV** Removes the installed NO2 sensor from the TG. This item is only visible if a NO2 sensor is presently installed. Confirmation is required to remove a sensor. (See *Sensor Replacement Instructions*)

**ESC** Exits back to the main Setup Menu screen.

# Testing Menu

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Access this menu by pressing the **◆** and **▼** buttons simultaneously for one second.

**INTV** Allows the user to set the testing interval. This interval will be acknowledged by all tests activated by the user until either the interval runs out or OFF is manually selected. Accepts any value between 0-300 in whole seconds.

Default: **10** Seconds

**OUT** Allows the user to force the output signal to its highest value (ie. 20mA in Current mode, or 10 Volts in voltage mode).

**On** Begin output testing

**OFF** Turn off output testing

**FAN** Allows the user to turn on the Fan relay for the length of the testing interval.

**On** Begin Fan relay testing.

**OFF** Turn off Fan relay testing.

**ALP** Allows the user to turn on the Alarm relay for the length of the testing interval.

**On** Begin Alarm relay testing.

**OFF** Turn off Alarm relay testing.

**BUZ** Allows the user to turn on the Piezo Buzzer for the length of the testing interval.

**On** Begin Buzzer testing.

**OFF** Turn off Buzzer testing.

## Idle Condition Codes

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**nnE** Set while there is no RS485 traffic detected. If the device is connected to an active RS485 network and this condition is set, check the RS485 connections on the TG device to ensure they are properly connected. If no traffic is expected to be on the line then this condition can be ignored.

**nbP** Set while RS485 is detecting the network baud rate.

**npP** Set while RS485 is detecting the network protocol.

**nAd** Set while RS485 is establishing a device address.

**LSU** Set while the supply voltage is below the minimum operating threshold stated in the datasheet and install guide.

**ETP** Set when the calculated temperature is below/above the minimum/maximum operating range of the TG device.



# Periodic Test and Maintenance

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For best performance, each TG product, along with associated ventilation and exhaust systems, require regular inspection and maintenance. Recommended field testing, maintenance, and sensor replacement procedures and intervals follow.

## 1. **Field Testing**

It is recommended that the TG unit be tested using a NIST traceable reference gas during installation, and annually thereafter. It is only necessary to use carbon monoxide (CO) or nitrogen dioxide (NO<sub>2</sub>) test gas if that sensing element is presently installed in the TG unit. Recommended test gas concentrations follow.

- CO: 100 PPM
- NO<sub>2</sub>: 10 PPM
- Gas contained within reference gas canisters degrades over time. The recommended shelf life of a reference gas canister can typically be found on its label, or by contacting the manufacturer.

## 2. **Periodic Maintenance**

Though the frequency of inspection is typically affected by the operating conditions (ie. extreme temperatures, extreme humidity, exposure to contaminants, etc.), recommended intervals follow. More frequent maintenance may be required per local code. An accurate log of all maintenance, gas tests, and abnormal occurrences should be maintained for the proper service of this product.

- **Every 6 Months**
  - Visually inspect to ensure optimum operating condition (no breakage, sensor filter not blocked or discolored, visual indicators operational, etc.).
  - Clean the exterior with a soft, water dampened cloth, if needed.
- **Annually**
  - Re-test the unit using NIST traceable reference gas to ensure sensors remain responsive.
- **DO NOT**
  - Expose the sensor to high pressure water spray.
  - Expose the unit to solvents.
  - Immerse the unit in liquids.

## 3. **Sensor Replacement Interval**

Typical sensor life spans follow.

- CO Sensor: 5 years, normal use at temperatures >10°C
- NO<sub>2</sub> Sensor: 5 years, normal use

The 5-year element lifespan is based on continuous usage from the time of initial installation. An internal clock tracks the life of the sensor in order to alert the customer when the sensor needs to be changed, which can only be done while the product is powered. When an element is within 30 days of its end of life, a green LED on the product will blink every 10 seconds to alert the customer that the sensor needs to be changed. Additionally, objects are provided in communications versions (Modbus/BACnet) to alert the user that it's time to replace the element.

Sensor life may be affected by certain operating conditions, or by exposure to concentrations higher than the detection range. To avoid inadvertent contamination of the sensor, product should remain in factory sealed bag prior to installation.

*For sensor element replacement, contact Senva: (866) 660-8864 or sales@senvainc.com.*