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# User's Guide

## TG Series

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***Senva Sensors***  
***9290 SW Nimbus Ave***  
***Beaverton, OR 97008***

# 154-0034-0C

<b>Rev.</b>	<b>Release Date</b>	<b>By</b>	<b>Description of Change</b>	<b>ECR</b>
0A	2/7/2020	CKB	Initial Release	---
0B	3/12/2021	CKB	Temperature Offset and Scale Factor Adjustment	---
0C	1/17/2023	CKB	Added sensor factory reset	---

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## References:

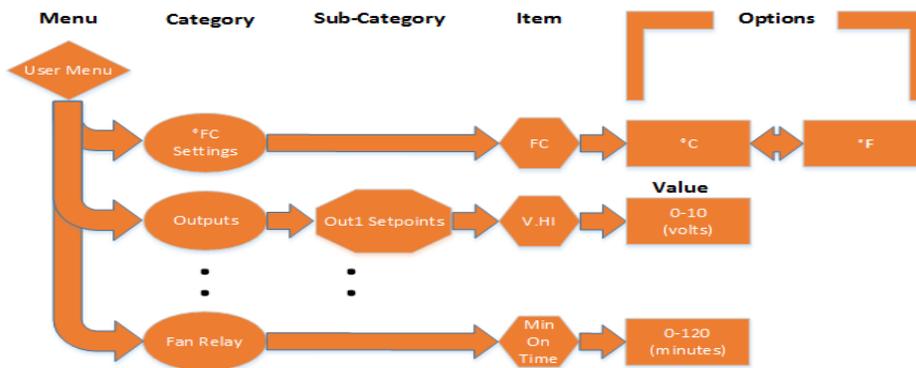
152-0380	TG Installation Instructions
152-0382	TG Sensor Replacement Instructions
154-0035	BACnet Protocol Guide
154-0036	Modbus Protocol Guide

# 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** – View sensor information and field calibration.
- **Testing Menu** – Test functionality of system interfaces, such as relays and analog output signals.

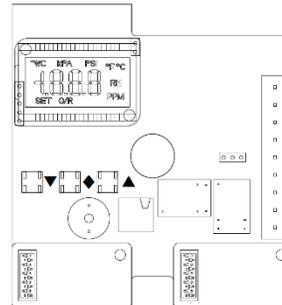
Each menu is composed of a hierarchy of primitive elements: *Categories*, *Items*, *Numerical Values*, and *Option Values*. *Categories* give you access to *Items*, which may contain either *Numerical Values* when the setting is numerical, or *Option Values* when the setting is multiple choice. A list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



**Figure 1:** TG menu structure example showing how to traverse the menu. To change °F to °C, enter User Menu, press **◆** on the °FC category, and then press **▲** or **▼** to change temperature units.

## Buttons

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



## Navigation and Selection

- Press **▲** or **▼** to step through Categories, Sub Categories, Items, Options, and to increment/decrements numerical values.
- 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.

\*Allow 10 seconds after making a change for the change to be written to non-volatile memory

# 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**

- **Display (d5P)**  
Customize the performance of the display.
- **Analog Output Channel 1 (OP1)**  
Contains all of the settings which control the output signal on channel 1. *(Analog Version only)*
- **Analog Output Channel 2 (OP2)**  
Contains all of the settings which control the output signal on channel 2. *(Analog Version only)*
- **RS485 (r54)**  
Manually set the RS485 communication settings. *(RS485 Version only)*
- **Sensor 1 Setpoints (S1)**  
Contains all user configurable setpoints, which control the system response to the installed gas sensor. See OP1 or OP2 to set the max and min analog output range. *(Requires sensor 1 to be installed)*
- **Sensor 2 Setpoints (S2)**  
Contains all user configurable setpoints, which control the system response to the installed gas sensor. See OP1 or OP2 to set the max and min analog output range. *(Requires sensor 2 to be installed)*
- **Temperature Setpoints (tP)**  
Contains all of the user configurable setpoints, as well as unit selection, which control the system response to the external thermistor. *(Requires external thermistor option)*
- **Fan Relay (FAN)**  
Configure the timing of the fan/warning relay.
- **Alarm Relay (ALP)**  
Configure the timing of the alarm relay.
- **Buzzer (bU2)**  
Configure the timing and functionality of the alarm buzzer.

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## dSP

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### SFC

Sets the sensor values to be displayed in Idle mode.

- 12t** Sensor 1, Sensor 2, and Temperature. (S1, S2, and thermistor must be installed)
- 1** Sensor 1. (Sensor 1 must be installed)
- 2** Sensor 2. (Sensor 2 must be installed)
- t** Temperature. (External thermistor must be installed)
- 12** Sensor 1, Sensor 2. (Sensor 1 and Sensor 2 must be installed) (Default)
- 1 t** Sensor 1, Temperature. (Sensor 1 and external thermistor must be installed)
- 2t** Sensor 2, Temperature. (Sensor 2 and external thermistor 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

### ITNU

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.

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## OP 1 / OP2

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### U\_C

Selects the output mode of the analog output signals. Changing this setting on either OP1 or OP2 sets the output mode on both analog output channels.

- UOL** Voltage Out (Default)
- CUF** Current Out

**SEN** Selects the sensor to be output on output channel 1 (OP1) or output channel 2 (OP2). By default, if a single sensor is present it will be configured on output channel 1. If two sensors are present, sensor 1 will default to output on channel 1, while sensor 2 will default to output on channel 2.

**NON** No sensor selected.

**S1** Sensor 1.

**S2** Sensor 2.

**°FC** Temperature.

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

**ULL** 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

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

**PGH** Sets the sensor reading to correspond to the max signal output. For example, if in 0-10V output mode, and this is set to 20 PPM, then when the sensor reads 20 PPM the voltage output from the device will be 10V.  
Default: Varies depending on sensor selected

**PGL** Sets the sensor reading to correspond to the min signal output. For example, if in 0-10V output mode, and this is set to 0 PPM, then when the sensor reads 0 PPM the voltage output from the device will be 0V.  
Default: Varies depending on sensor selected

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

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# RS4

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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)

<b>96</b>	9600 Baud
<b>192</b>	19,200 Baud
<b>288</b>	28,800 Baud
<b>384</b>	38,400 Baud
<b>576</b>	57,600 Baud
<b>768</b>	76,800 Baud
<b>115</b>	115,200 Baud
<b>230</b>	230,400 Baud
<b>460</b>	460,800 Baud

**Pro** Sets the RS485 protocol.  
*RS485 Version Only: MSV122 (BACnet), R122 (Modbus).*

<b>Aut</b>	Auto Protocol (Default)
<b>bAC</b>	BACnet
<b>ASC</b>	Modbus ASCII
<b>RTU</b>	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

**S.b** 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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**SPH** Sets the alarm setpoint level.  
*RS485 Version Only: AV152 /AV162 (BACnet), R152 /R162 (Modbus).*  
Default: Varies depending on sensor installed

**SP.L**

Sets the warning setpoint level.

*RS485 Version Only: AV150/AV160 (BACnet), R150/R160 (Modbus).*

Default: Varies depending on sensor installed

**HYS**

Sets the setpoint hysteresis. 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/AV164 (BACnet), R154/R164 (Modbus).*

Default: Varies depending on sensor installed

**PUL**

Sets whether or not the pulse check feature for the sensor is active. This feature only works with electrochemical type sensors. Every 10 minutes the system will send a pulse to the sensor to test its response. If the device fails this check 4 times in a row then the status of the sensor's reliability is changed from "No Fault Detected" to "No Sensor" (BACnet sensor reliability). The device will also blink the Red system LED 8 times and activate the buzzer for a very short duration every 60 seconds until the problem is resolved, the unit is powered down, or the feature is turned off.

*RS485 Version Only: BV196/BV197 (BACnet), R196/R197 (Modbus)*

Default: **OFF**

**ESC**

Returns to the User Menu screen.

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**EP**

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**FC**

Selects the temperature display units.

*RS485 Version Only: MSV133 (BACnet), R133 (Modbus).*

**°C**      Degrees Celsius

**°F**      Degrees Fahrenheit (Default)

**LYP** Select thermistor type.

non	No Thermistor
C	100PT
d	1000PT
E	10KT2
F	10KT3
G	100K
H	3K
I	2K2
J	1K8
20	20K

**OFFS** Sets the temperature offset, -40 to 40. This field has no units, and will add/subtract this value from the temperature reading as is. If you change temperature units from °C to °F, or vice versa, you may need to update this value.  
*RS485 Version Only: AV130 (BACnet), Not available on Modbus.*  
Default: 0

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

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## FAN

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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

**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.  
*RS485 Version Only: AV212 (BACnet), R212 (Modbus).*  
Default: 0 Minutes

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

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## **ALP**

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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

**FEH** 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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## **BUZ**

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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

dI 5

Disables the on board alarm buzzer. Persists through power cycle. When On the buzzer is disabled, when Off the buzzer is enabled.

Default: OFF

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

- **Version (VER):** View the version number of the firmware installed on the TG.
- **Sensor 1 (S1):** Allows the user to view information about the sensor 1, such as sensor lifetime, as well as begin field calibration.
- **Sensor 2 (S2):** Allows the user to view information about the sensor 2, such as sensor lifetime, as well as begin field calibration.
- **Reset (RST):** Resets the device configuration to its factory default settings. Green LED will blink 3 times to indicate the reset was successful.
- **Firmware Version (VER):** Firmware version presently running on the device.

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### EOL

View the number of days remaining in the sensor's lifespan. This value can be used to verify whether a sensor needs to be replaced in the near future. If the number of days is greater than 1999, then the value displayed will be 1999. If the days fall below 30 the device will blink a red LED 8 times every 60 seconds to inform you of the sensor's nearing end of life.

NOTE: This is different from the recommended annual calibration cycle, which tests the wellness and functionality of the sensor.

### CAL

Begin field calibration. Hold all 3 buttons down for 1 second in order to cancel field calibration.

### SFA

A percentage value from 25% to 250%, which can be used to adjust the final reading of the sensor. If field calibration is too cumbersome, or only a micro-adjustment needs to be made while reading gas, you can modify this value rather than field calibrating the device.

Default: 100%

**ZER** Zero the baseline of the sensor. Environmental changes can impact the baseline measurement of certain sensor types, by using the Zero feature you can reset the baseline back to zero.

**RST** Reset sensor baseline and scale factor back to factory defaults.

**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). (*Analog version only*)  
**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.

# 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: >7 years, normal use at temperatures >10°C
- NO<sub>2</sub> Sensor: >7 years, normal use

The 7-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 red LED on the product will blink 8 times and an audible alarm will chirp every 60 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 (AV158/AV168 BACnet, R158/R168 Modbus).

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](mailto:sales@senvainc.com).*