GasBadge Plus®

Personal Single Gas Monitor V3.0

Activation • Operation • Troubleshooting

Part Number: *17120932-1*
Revision: *5*

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Warnings and Cautionary Statements

IMPORTANT: Failure to perform certain procedures or note certain conditions may impair the performance of this product. For maximum safety and optimal performance, please read and follow the procedures and conditions listed below.

IMPORTANT: Read and understand this manual before operating. Contact your service representative immediately if you suspect that the GasBadge Plus is working abnormally.

WARNING: Explosion Hazard – The GasBadge Plus contains no serviceable parts.

WARNING: Substitution of components may impair intrinsic safety.

WARNING: Instrument contains a Lithium battery which may leak or explode if the instrument is mistreated. Do not attempt to disassemble or dispose of in fire.

WARNING: The GasBadge Plus is marked with the symbol "Exia", which is used by the Canadian Standards Association to designate the instrument as INTRINSICALLY SAFE. The intrinsic safety is not certified by CSA when this instrument is used in atmospheres containing oxygen concentrations above 21%.

The GasBadge Plus is certified for use within ambient temperature range of -40° C to 60° C.

The GasBadge Plus complies with the relevant provisions of European ATEX Directive 94/9/EC and EMC Directive 89/336/EEC, amended by Directives 92/31/EEC and 92/31/EEC and 93/68/EEC.

The EC Type Examination Certificate is DEMKO 09 ATEX 0844098 with marking Code Ex ia IMa / Ex ia IIC T4 Ga, for Equipment Group and Category I M1 and II 1G.

The IECEx Type Examination Certificate is UL 09.0015 with marking code Ex ia IIC T4 Ga.

The GasBadge Plus devices (P/N: 18100050) are constructed with reference to published standards of Directive 72/23/EEC, to eliminate electrical risks and fulfill 1.2.7 of Annex II of Directive 94/9/EC.

For purposes of minimizing electromagnetic interference (EMI) and radio-frequency interference (RFI) in the application environment, the alarm functions of the GasBadge Plus are unaffected when placed in close proximity to handheld radios[1]. This applies to all sensors specified for this instrument.

Never cover or insert foreign objects into the alarm signal opening. The opening must remain clear and free of foreign objects, otherwise any alerts made during an alarm state may not be heard or identified.

The use of leather cases can produce inaccurate readings with diffusion (non-aspirated) gas detection instruments for specific monitoring applications. Leather cases should be used ONLY as carrying cases, and NOT for continuous monitoring, with diffusion instruments configured to measure gases **<u>other than</u>** O_2, CO, CO_2, H_2S, and combustible gases (LEL/CH_4).

[1] Within 1 meter of a handheld radio emitting an electromagnetic signal of up to 5 watts in the frequency range of 80 MHz to 2.4 GHz.

Hardware Overview

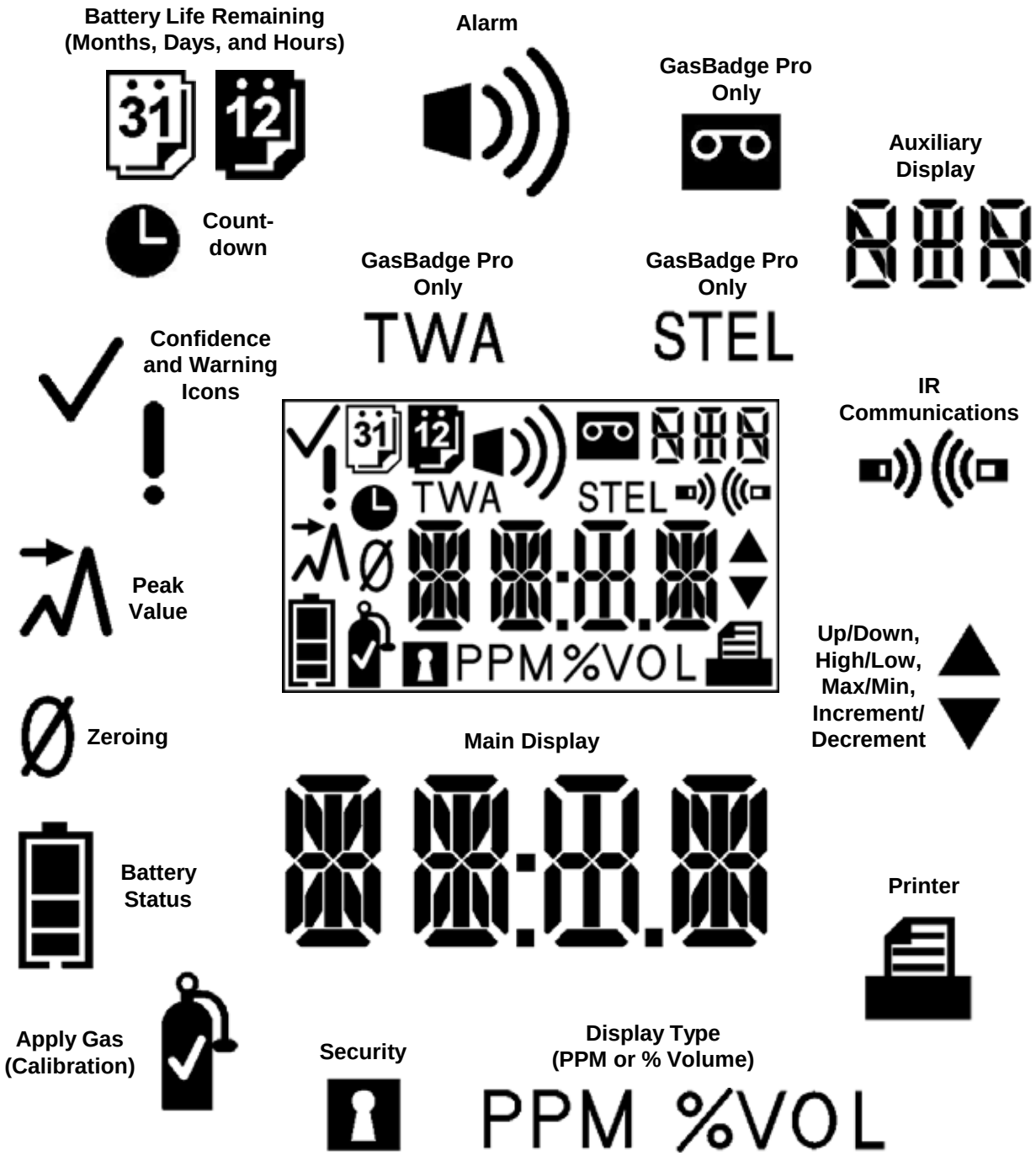
Unpacking the Instrument

The shipping box should contain the following items. Account for each item before discarding the box.

Quantity	Part Number	Description
1	18100050-X	GasBadge® Plus Monitor
1	17120932	Manual
1	17124033	Cal-Cup
1	17120643	Replacement Sensor Water Barrier/Filter
1	17121385	Quick Start Guide

After unpacking, if any listed item is missing, contact either your local distributor of Industrial Scientific products or call Industrial Scientific Corporation at 1-800-DETECTS (338-3287) in the United States and Canada, or 412-788-4353.

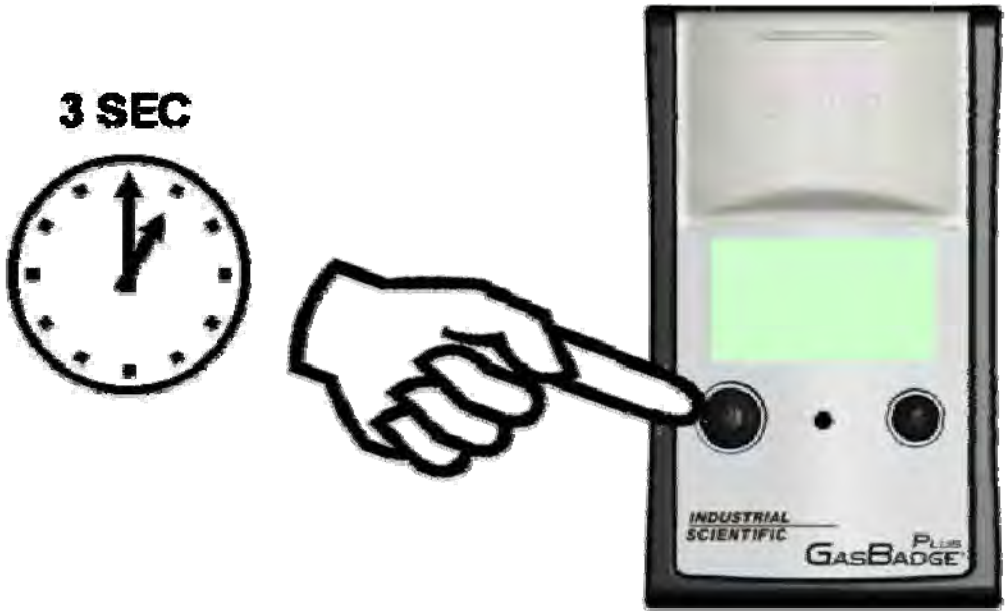
Display Overview



LCD Display Panel Overview

Activation

To turn on the GasBadge Plus, hold the Mode button for at least 3 seconds.



Activating the GasBadge Plus Personal Monitor

Each alarm indicator – the left LED, the right LED, the speaker, the vibrating alarm, and the backlight – will be tested for one second. Following the segment and alarm indicator test, the instrument will display the software version.

IMPORTANT: Once the GasBadge Plus is activated, it cannot be turned off.

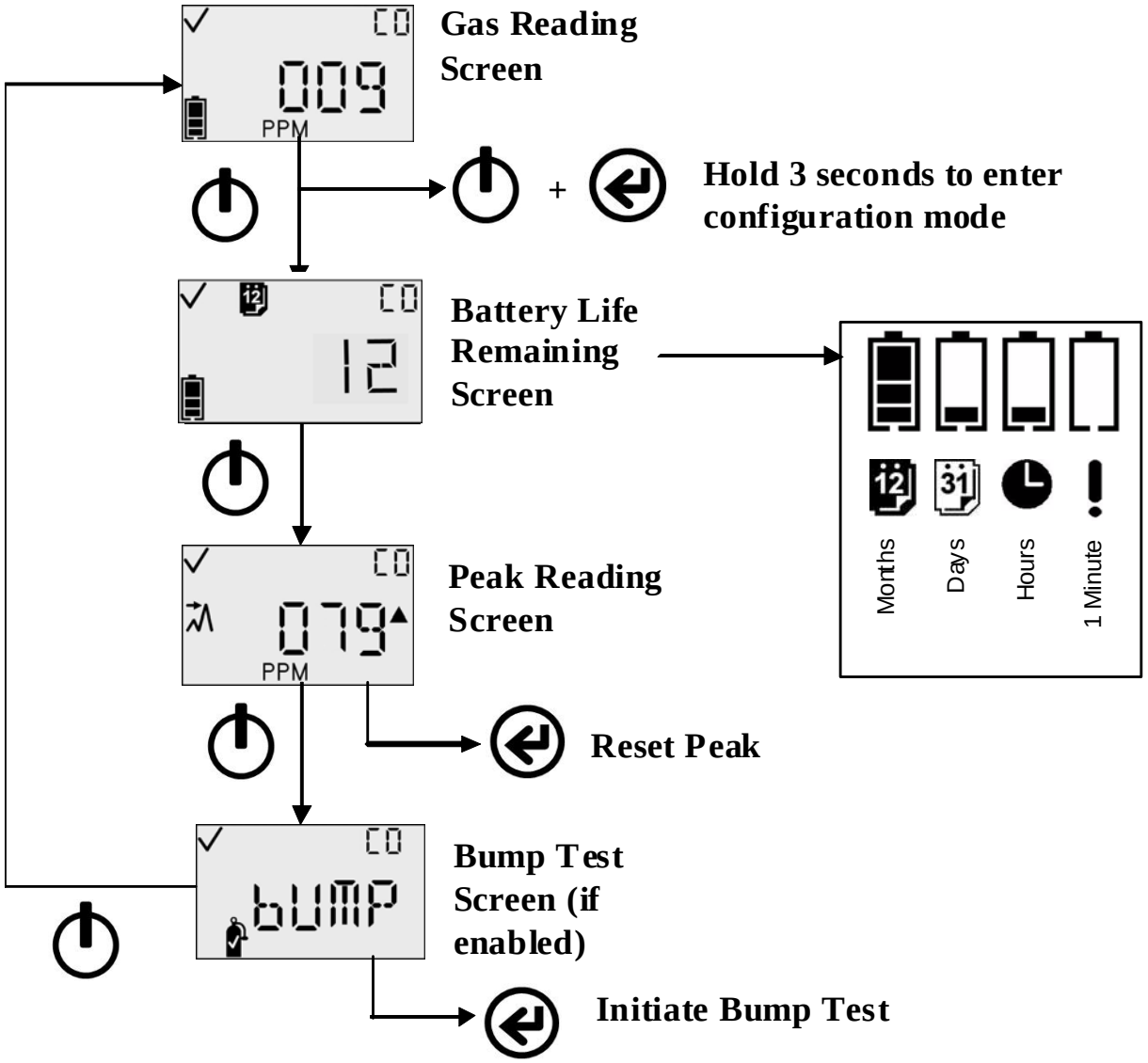
NOTE: Any button press activates the backlight for a period of 3 seconds.

Countdown Screen

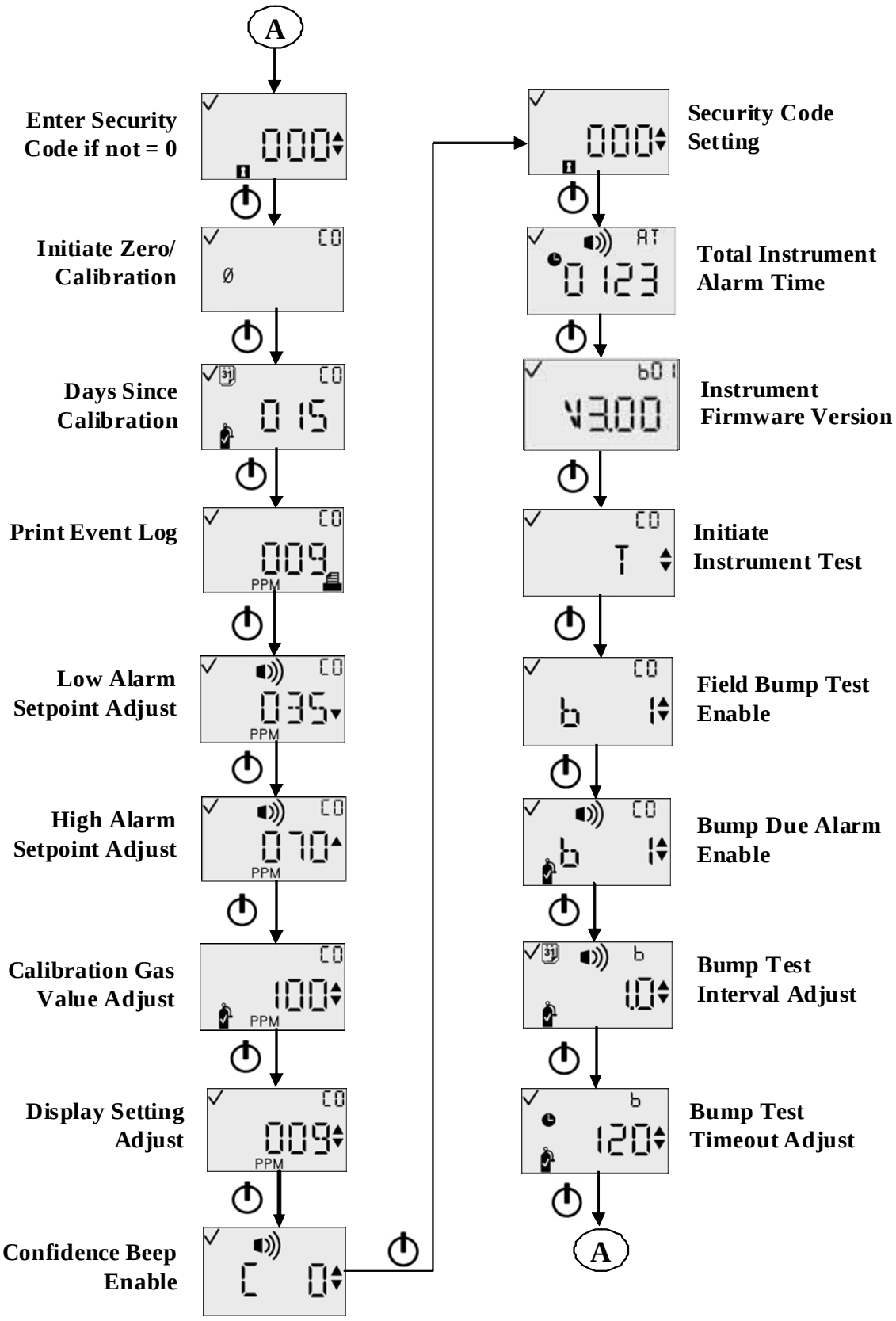
The countdown screen is entered after the Software Version screen times out. The primary display will show a decrementing countdown from 20 seconds. After the countdown, the GasBadge Plus proceeds to the Gas Monitoring screen. The confidence Checkmark Indicator is active at this point, indicating that all internal checks have passed.

Countdown Screen

Basic Operating Flowchart



Configuration Mode Flowchart



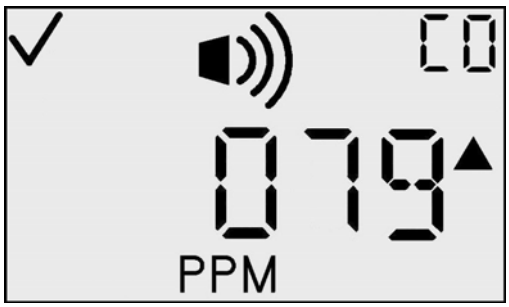
Gas Monitoring Screen

The primary operating screen is the Gas Monitoring screen. The Gas Monitoring screen may utilize one of three displays:

- Concentration in PPM (for toxic sensors)
- Concentration in Percent Volume (for oxygen sensors)
- Gas Sensor type only (selectable for either sensor type).

The Enter button activates the backlight and initiates IR print.

In the presence of a gas concentration that exceeds the low or high level threshold, the instrument will enter an alarm screen. Alarm detection in any of the instrument's normal operating screens – the battery life, peak, or initiate print screens – will force a transition back to the Gas Monitoring screen. The alarm screen is indicated on the display by the Alarm Indicator and either the Up Indicator or Down Indicator which designate a low or high alarm.



High Alarm Screen

These icons are in addition to the values and icons normally displayed in the current monitoring screen. From this screen, the Mode button can toggle through the menus.

Actions Available from Monitor Screen

Action	Response
Mode button press	Go to Battery Life Remaining
Enter button press	Backlight turns on; Initiates IR print
Mode and Enter buttons held (3 sec.)	If security code > 0, go to Enter Security Code If security code on the screen is correct, go to Zero Initiate (or Calibration screen for O_2)

NOTE: In an over-range condition, the display will show a blinking "OR". Any over-range values in the event log or peaks will be truncated at the measurement range of the sensor.

Event Log

The GasBadge Plus stores alarm events in non-volatile memory. The last 15 gas alarm events are stored with continuous-loop logging. The information stored for each event is:

- gas type
- peak exposure level (ppm or %)
- alarm duration in minutes/seconds
- cumulative alarm time prior to alarm event
- battery life remaining prior to alarm event
- relative time that alarm occurred.

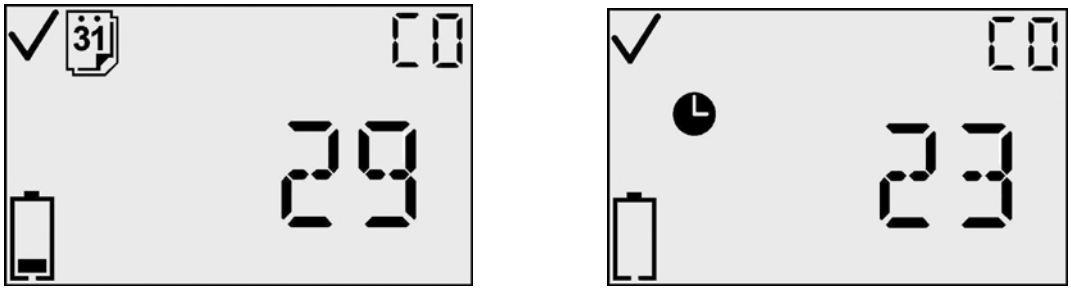
Battery Life Remaining

The Battery Life Remaining screen presents the battery life remaining in months. The battery indicator will be active to present the battery screen as low, medium, or full. The Month Icon will be active to indicate that this is the number of months. The instrument will continue to indicate the sensor type on the auxiliary display and the Checkmark Indicator if appropriate.

Battery Life Remaining Screen – Months

After 30 seconds, this screen will timeout and return to the Gas Monitoring screen. Pressing the Mode button at this screen will scroll to the Peak Gas Reading screen.

When there are 31 days or less of battery life remaining, the battery life will be displayed in days, and the Days Icon will replace the Months Icon. When there are 24 hours or less of battery life remaining, the battery life will be displayed in hours, and the Clock Icon will replace the Months or Days Icon.

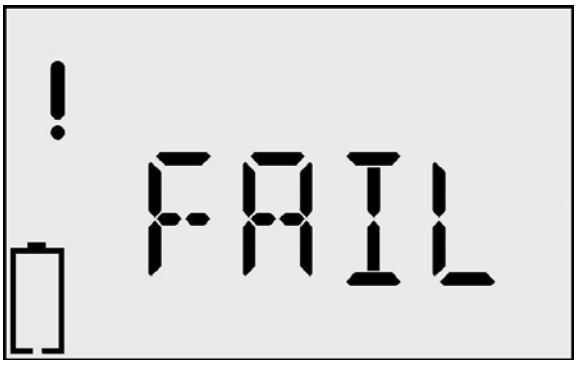


Battery Life Remaining Screen – Days (Left) and Hours (Right)

Actions Available from the Battery Life Remaining Screen

Action	Response
Mode button press	Go to Peak Gas Reading
Enter button press	Backlight turns on
Mode and Enter buttons held (3 sec.)	If security code > 0, go to Enter Security Code If security code on the screen is correct, go to Zero Initiate (or Calibration screen for O_2)
30 second timeout	Go to Gas Monitoring screen
Gas alarm event	Go to Gas Monitoring screen

When the instrument reaches the end of its useful life, the word FAIL will appear on the instrument's display and both the audible and visual alarms will be activated; **the unit should be removed from service immediately.** The unit will remain in this alarm state for 10 minutes; during this time, it will no longer detect gas. After 10 minutes in this alarm state, the words "call ISC" will appear on the display and both the audible and visual alarm will cease.



Battery Failure Screen

Actions Available from the Battery Failure Screen

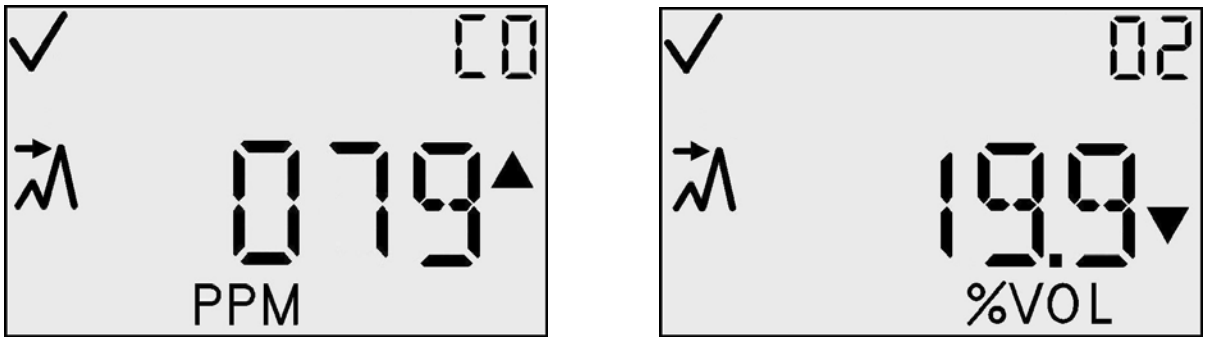
Action	Response
Mode button press	No response
Enter button press	No response
After 10 minutes.	Instrument displays "call ISC"

Peak Reading

The Peak Gas Reading screen presents the peak reading since the last time the peak was cleared. The peak reading will be accompanied by the appropriate concentration indicator (PPM or %VOL) and the corresponding Up Indicator or Down Indicator, representing a maximum reading (for toxics) or minimum reading (for oxygen) respectively. After 30 seconds, this screen will timeout and return to the main monitoring screen. Pressing the Mode button at this screen will scroll back to the Gas Monitoring screen.

Pressing the Enter button on the Peak Gas Reading screen will clear the peak value. On O_2 instruments, the depletion peak will be cleared to 20.9%.

NOTE: The GasBadge Plus retains the maximum gas reading (for a toxic sensor) and the minimum gas reading (for an O_2 sensor) for later viewing.



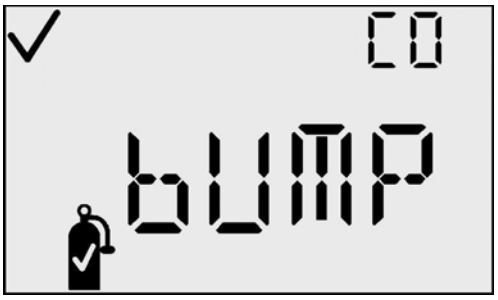
Peak Reading Toxic (Left) and Peak Reading Oxygen Depletion (Right) Screens

Actions Available from the Peak Reading Screen

Action	Response
Mode button press	Go to Gas Monitoring Screen
Enter button press	Clears peak; backlight turns on
Mode and Enter buttons held (3 sec.)	If security code > 0, go to Enter Security Code If security code on the screen is correct, go to Zero Initiate (or Calibration screen for O_2)
30 second timeout	Go to Gas Monitoring screen
Gas alarm event	Go to Gas Monitoring screen

Bump Test

The bump test screen allows the user to initiate and perform a manual bump test of the instrument using calibration gas. (This screen will only be seen if the bump test option is enabled in the configuration mode.) After initiating the bump test by pressing the Enter button at this screen, the user will apply the calibration gas to the instrument as described previously under Calibration.

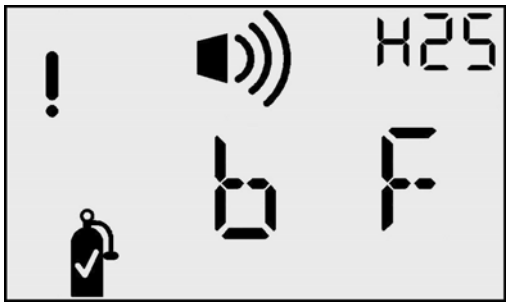


Actions Available from the Bump Test Screen

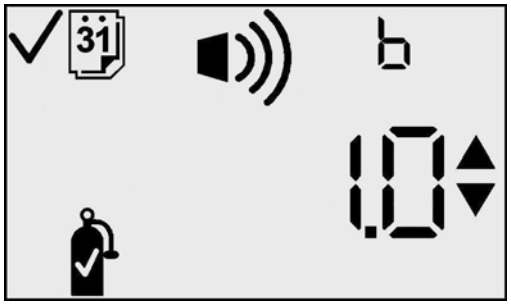
Action	Response
Enter button press	Initiate bump test.
Mode button press	Go to Peak Reading screen.
30 second timeout	Go to Gas Monitoring screen.

If the sensor responds to 50% of the calibration gas value within the timeout specified in the configuration mode the instrument will pass the bump test.

If not, the instrument will fail the bump test and a bump fault screen ("bF") will display as shown here. The instrument is placed in periodic alarm until it passes a bump test.



If the bump overdue alarm is enabled in the configuration mode, this screen will appear on the instrument and remain until a bump test of the instrument is completed successfully.



Actions Available from the Bump Overdue Alarm Screen(TCM)

Action	Response
Mode button press 	Go to Bump Test Interval screen
Enter button press 	Toggle value between 0 and 1. (Default is "0" = Bump Overdue Alarm disabled
30 second timeout 	Go to Gas Monitoring screen.

Bump Testing

IMPORTANT: A function or "bump" test, using a known concentration of calibration gas, should be performed periodically based on instrument use, exposure to gas, and environmental conditions. The frequency is best determined by company policy or local regulatory agencies. If an instrument fails a function or "bump" test, or, if it is dropped, submerged, or appears damaged, a full calibration is recommended. The safest approach is to perform a function or "bump" test prior to each day's use. Industrial Scientific is not responsible for establishing customer safety practices and policies.

Configuration Mode

NOTE: For flowchart view of Configuration Mode, see pages 6 and 7.

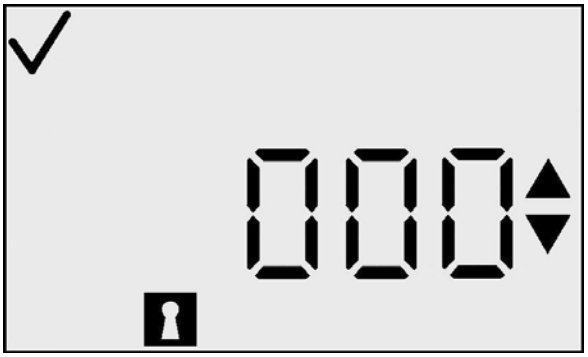
Introduction

The configuration mode is used to change or set several options, as well as to zero and calibrate the instrument. Gas alarm indications will occur in configuration mode, with two exceptions: no alarms will occur during the zeroing/calibration process, and gas alarms will not cause the menu flow to jump back to the Gas Monitoring screen. The configuration screen is reached from the normal operating screen by holding both buttons for three seconds at the Gas Monitoring screen. Once in configuration mode, if the Mode and Enter buttons are both held for 3 seconds, the instrument will exit the configuration screen and return to the Gas Monitoring screen. In addition, from anywhere within the configuration screens (except during zeroing and calibration), the instrument will return to the Gas Monitoring screen if no buttons are pressed for 30 seconds.

Security Code

The Security Code screen is the first screen in the configuration mode. The default security code is 000. If this is the stored value of the security code, the instrument bypasses this screen and displays the Zero Initiate screen.

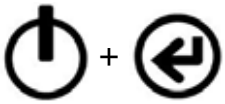
On entering the Enter Security Code screen, the primary character display will show the number '000'. All characters of the primary display will blink to indicate that they are ready to change. Enter the security code by pressing the Enter button. Momentary presses of the Enter button will increment the security code by one count. Holding the Enter button for an extended period will activate an accelerated number increment.



Enter Security Code Screen

Once the correct code is reached, pressing the Mode button will navigate to the next configuration screen which is the Zero Initiate (or, for O2 sensors, Cal Initiate) screen. If the Mode button is pressed while the wrong code is displayed, the instrument will leave the configuration screen and return to the Gas Monitoring screen.

Actions Available from the Enter Security Code Screen

Action		Response
Mode button press		If security code on screen is correct, go to Zero Initiate (or Calibration screen for O_2) If security code on screen is incorrect, go to Gas Monitoring screen
Enter button press		Increment display value
Mode and Enter buttons held (3 sec.)		Go to Gas Monitoring screen
30 second timeout		Go to Gas Monitoring screen

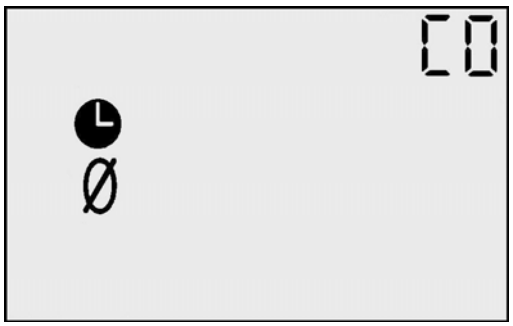
Zero Initiate (Toxic Sensors Only – For Oxygen, Skip to Calibration Section)

IMPORTANT: Before zeroing, ensure the instrument is located in a fresh air environment. If background gas is present, the use of a zero air cylinder is recommended.

The Zero screen allows you to begin the zeroing process (for toxic sensors), by pressing the Enter button. The Zero icon will blink, signifying that zeroing will begin if you press Enter. For Oxygen sensors, this screen will not be displayed. Pressing the Mode button at this screen will navigate to the Days Since Calibration screen.

While zeroing, the display will show the zero icon, the gas type, and a blinking clock icon to show that this step will take some time. Once complete, the instrument will show either a “Pass” or “Fail.”

Zero Initiate Screen



Zeroing In Process

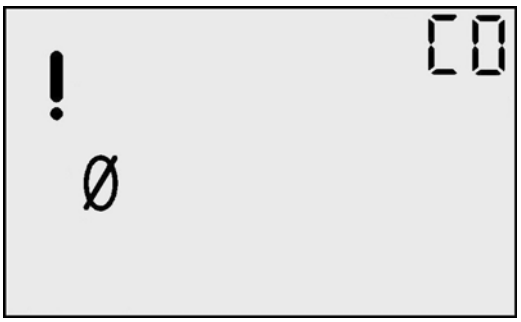
Actions Available from the Zero Initiate Screen

Action	Response
Mode button press	Go to Days Since Calibration screen
Enter button press	Go to Zero In Process
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen
30 second timeout	Go to Gas Monitoring screen

Zeroing Failed

The Zeroing Failed screen is displayed as a zero icon and a flashing warning icon. The instrument will remain in periodic alarm (one alarm burst every 15 seconds) while in this condition, to attempt to conserve battery life.

From this screen you only have the option to repeat the zeroing process by pressing the Enter button.



Zeroing Failed Screen

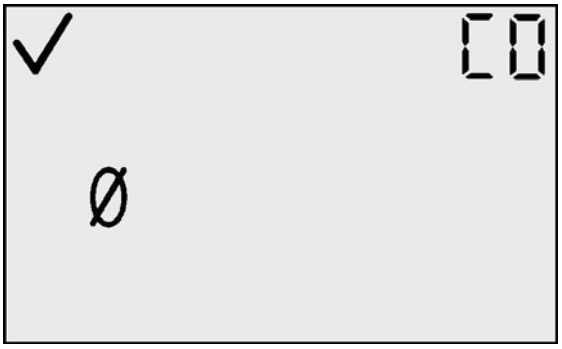
NOTE: If the instrument is connected to the Cal Plus™ calibration station while in Zero Fail state, the alarms will NOT activate until the instrument is disconnected from the bump/calibration station.

Actions Available from the Zeroing Failed Screen

Action	Response
Mode button press	No response
Enter button press	Go to Zeroing In Process
Mode and Enter buttons held (3 sec.)	No response

Zero Passed

The Zero Passed screen shows that the zero process completed successfully. After 5 seconds, the Calibration screen is displayed.



Zero Passed Screen

Actions Available from the Zero Passed Screen

Action	Response
Mode button press	Go to Zero Initiate screen
Enter button press	Go to Calibration screen
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen
5 second timeout	Go to Calibration screen

Calibration

Calibrating with Ambient Air (Oxygen Sensors Only)

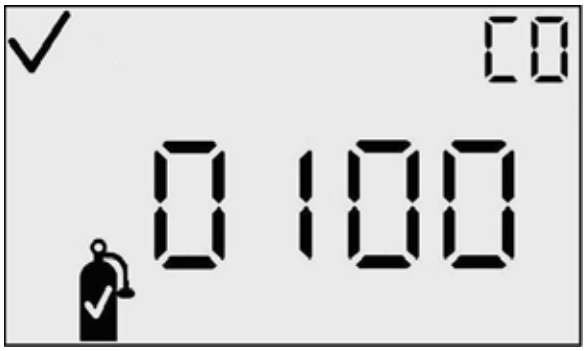
NOTE: Clean ambient air may be used for oxygen calibration. If a clean air environment is in question or if a zero air cylinder calibration is preferred, please skip to the Calibrating with Gas Cylinders section.

On the Calibration screen, the Cal Gas bottle will flash, notifying you to press

Calibration Cup

Enter to begin calibration.

Upon completion of calibration, the instrument will beep once, and either Cal Passed (✓) or Cal Failed (!) will be displayed along with the sensor span reserve. If Cal Passed, pressing the Mode button displays the Days Since Last Calibration screen. If Cal Failed, see Actions Available from Cal Failed Screen chart.



Calibration Screen

Calibrating with Gas Cylinders
(Toxic Sensors or Zero Air Cylinder Calibration)

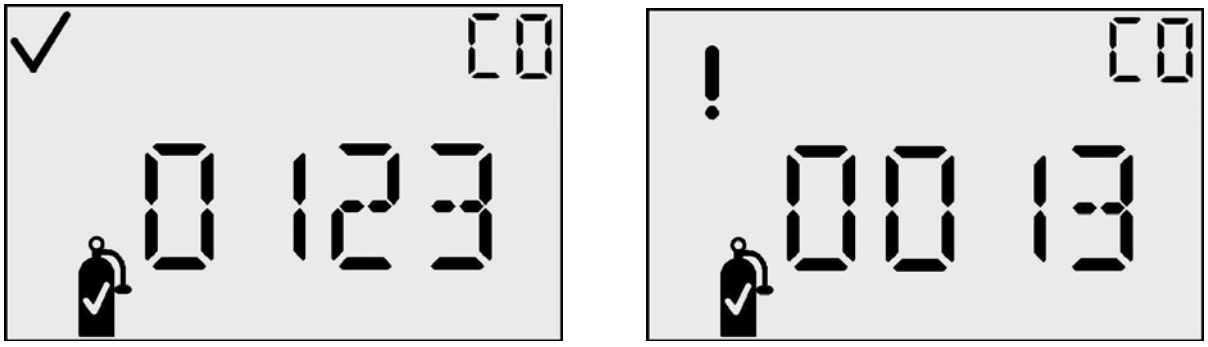
Place the supplied calibration cup onto the top of the instrument and connect the calibration cup to the gas cylinder with the supplied tubing.

On the Calibration screen, the Cal Gas bottle will flash, notifying you to apply the gas concentration shown and press Enter to begin calibration. Calibrate using a flow rate of 0.5 LPM.

Upon completion of calibration, the instrument will beep once and either Cal Passed (✓) or Cal Failed (!) will be displayed along with the sensor span reserve. If Cal Passed, pressing the Mode button displays the Days Since Last Calibration screen. If Cal Failed, see Actions Available from Cal Failed Screen chart.

Actions Available from the Calibration Screen

Action	Response
Mode button press	Go to Days Since Last Cal screen
Enter button press	Begin calibration (Use flow rate of 0.5 LPM)
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen
5 second timeout	Go to Gas Monitoring screen



Sample Cal Passed (✓) and Cal Failed (!) Screens

Actions Available from the Cal Passed (✓) Screen

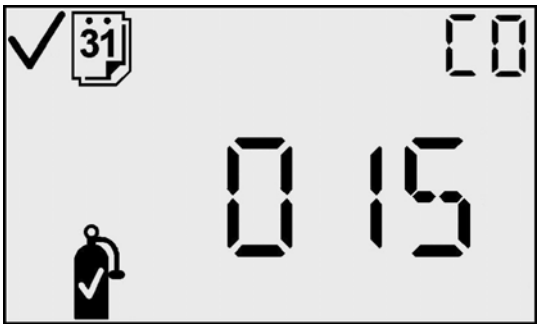
Action	Cal Passed (✓) Response	
	Toxic Sensor	**Oxygen Sensor**
Mode button press	Go to Days Since Last Cal screen	Go to Days Since Last Cal screen
Enter button press	No response	No response
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen	Go to Gas Monitoring screen

Actions Available from the Cal Failed (!) Screen

Action	Cal Failed (!) Response	
	Toxic Sensor	**Oxygen Sensor**
Mode button press	No response	No response
Enter button press	Go to Zeroing In Process	Go to Calibration
Mode and Enter buttons held (3 sec.)	Go to Zero Initiate screen	Go to Calibration screen

Days Since Calibration

The Days Since Calibration screen indicates the number of days that have passed since the last calibration. The Days Indicator is active to designate this number as days and the Gas Bottle indicator is active to designate it as a calibration issue. Pressing the Mode button at this screen will navigate to the Initiate Print screen.



Days Since Calibration Screen

Actions Available from Days Since Calibration Screen

Action	Response
Mode button press	Go to Initiate Print
Enter button press	No response
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen
30 second timeout	Go to Gas Monitoring screen

Event Log

The GasBadge Plus stores alarm events in non-volatile memory. The last 15 gas alarm events are stored with continuous-loop logging. The information stored for each event is:

- gas type
- peak exposure level (ppm or %)
- alarm duration in minutes/seconds
- cumulative alarm time prior to alarm event
- battery life remaining prior to alarm event
- relative time that alarm occurred.

Continuous-loop logging means that once the maximum number of alarm events has been recorded, the instrument automatically overwrites the oldest alarm event.

The event log can be printed directly to an infrared point-of-sale (POS) printer available from Industrial Scientific, or it can be downloaded to a PC via a Datalink or Cal Plus™ accessory product.

Initiate Print

The Initiate Print screen allows you to print the last 15 alarm events to an infrared printer. The display will be exactly the same as in the monitoring screen with one exception – the Print Indicator will be active. Pointing the IRDA port (bottom of the instrument) toward the printer and pressing the Enter button at this time will initiate the print function. While data is transmitted from the instrument, the Print icon will blink.

Initiate Print Screen

Actions Available from the Initiate Print Screen

Action	Response
Mode button press	Go to Low Alarm Setpoint screen
Enter button press	Initiates an IRDA print Backlight turns on
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen
30 second timeout	Go to Gas Monitoring screen
Gas alarm event	Go to Gas Monitoring screen

After 30 seconds with no buttons pressed or data being transferred, this screen will timeout and return to the Gas Monitoring screen. Pressing the Mode button at this screen, without initiating a print, will scroll to the Low Alarm Setpoint screen.

Low Alarm Setpoint

The Low Alarm Setpoint display is used to set the threshold for the low alarm. For an oxygen sensor, this threshold indicates the depletion oxygen concentration at which the alarm will be activated.

On entering this screen, the display will show the present threshold value. All characters of the primary display will blink to indicate that they are ready to change. The threshold is incremented by pressing the Enter button. Simple momentary presses will increment the value by 1 unit. Holding the Enter button for an extended time will increment the value much faster.

Low Alarm Setpoint Screen

Upon reaching the maximum value (which is sensor dependent), the display will roll over. Pressing the Mode button from this display causes a transfer to the High Alarm Setpoint screen.

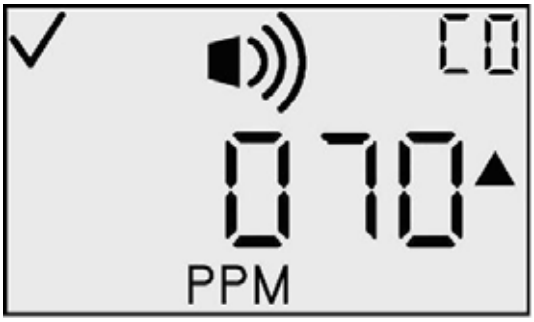
Actions Available from the Low Alarm Setpoint Screen

Action	Response
Mode button press	Accept value, then go to High Alarm Setpoint
Enter button press	Increment display value
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen
30 second timeout	Go to Gas Monitoring screen

High Alarm Setpoint

The High Alarm Setpoint screen is used to set the threshold for the high alarm. For an Oxygen sensor, this threshold indicates the enrichment oxygen concentration at which the alarm is activated.

On entering this screen, the display shows the present threshold value. All characters of the display blink to indicate that they are ready to change. The threshold is incremented by pressing the Enter button. Simple momentary presses will increment the value by 1 unit. Holding the Enter button for an extended time increments the value much faster.



High Alarm Setpoint Screen

Upon reaching the maximum value (which is sensor dependent), the display rolls over to the minimum value. Pressing the Mode button from this display causes a transfer to the Cal Gas Setpoint screen.

Actions Available from the High Alarm Setpoint Screen

Action	Response
Mode button press	Accept value, then go to Cal Gas Setpoint
Enter button press	Increment display value
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen
30 second timeout	Go to Gas Monitoring screen

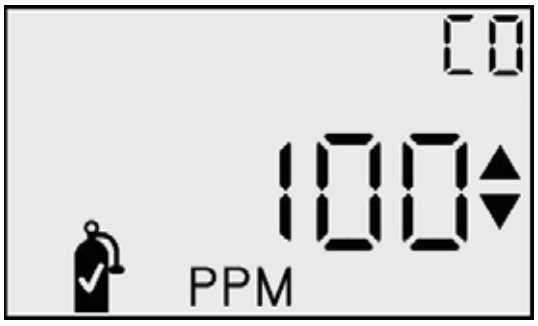
Low-level and high-level alarms have a setpoint stored in the GasBadge Plus. The calibration gas concentration setpoint is also stored in the instrument.

Default Alarm Setpoints for GasBadge Plus Instruments

Sensor	Low Alarm Setpoint	High Alarm Setpoint	Cal Gas Concentration Setpoint	Units
CO	35	70	100	ppm
H_2S	10	20	25	ppm
O_2	19.5	23.5	20.9	% by vol
SO_2	2	4	10	ppm
NO_2	3	6	25	ppm

Cal Gas Setpoint

The Cal Gas Setpoint screen is used to set the calibration gas concentration. On entering this screen, the display will show the present threshold value. All characters of the primary display will blink to indicate that they are ready to change. The threshold is incremented by pressing the Enter button. Simple momentary presses will increment the value by 1 unit.



Cal Gas Setpoint

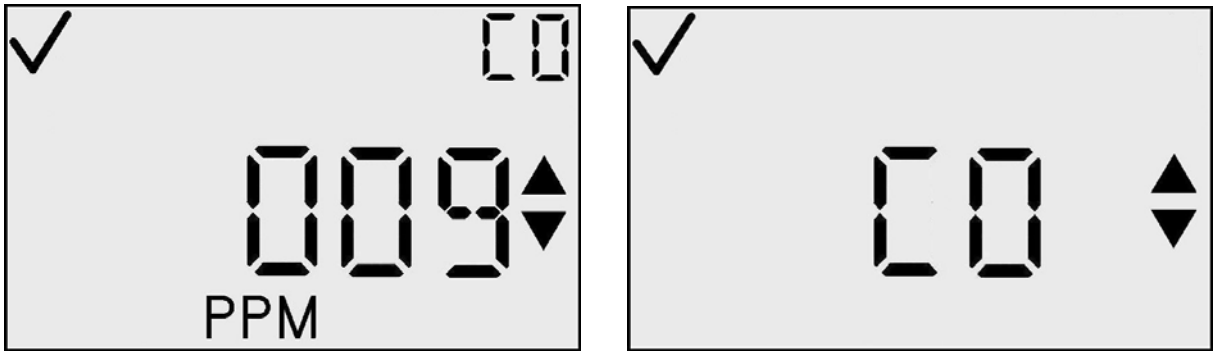
Holding the Enter button for an extended time will increment the value much faster. Upon reaching the maximum value (which is sensor dependent), the display will roll over to the minimum value. Pressing the Mode button from this display causes a transfer to the Set Display Type screen.

Actions Available from the Cal Gas Setpoint Screen

Action	Response
Mode button press	Accept value, then go to Set Display Type
Enter button press	Increment display value
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen
30 second timeout	Go to Gas Monitoring screen

Set Display Type

The Set Display Type screen is used to set the display type for monitoring in normal instrument operation. Pressing the Enter button on this screen will toggle between the two display modes – Gas Reading, or Sensor Type Only. On the Gas Reading screen, the actual current gas concentration will be placed on the primary display, and the sensor type on the auxiliary display, along with the up and down arrows to indicate that the display type can be modified. On the Sensor Type Only screen, the sensor type will move to the primary display, and the auxiliary display will be blank. Pressing Mode will move to the Set Confidence Indicator screen.



Set Display Type - Gas Reading (Left) and Sensor Type Only (Right)

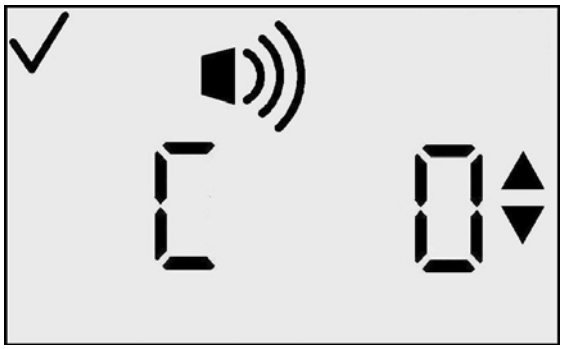
Actions Available from the Set Display Type Screen

Action	Response
Mode button press	Go to Set Confidence Indicator
Enter button press	Toggle display type setting
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen
30 second timeout	Go to Gas Monitoring screen

Set Confidence Indicator

The Set Confidence Indicator screen is used to enable the confidence indicator during monitoring in normal instrument operation. A value of '0' indicates that the confidence indicator 'flash' is to be disabled. A value of '1' indicates that the confidence indicator 'flash' will be enabled.

On entering the screen, the primary character display will show the present confidence value. The rightmost character of the primary display will blink to indicate that it is ready to change. The Enter button will toggle the rightmost character between 0 and 1. The Mode button will cause a transition to the Set Security Code screen.



Set Confidence Indication

Actions Available from the Set Confidence Indication Screen

Action	Response
Mode button press	Go to Set Security Code
Enter button press	Toggle Confidence Indication setting
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen
30 second timeout	Go to Gas Monitoring screen

NOTE: When the confidence indicator is enabled, the monitor will flash every 90 seconds.

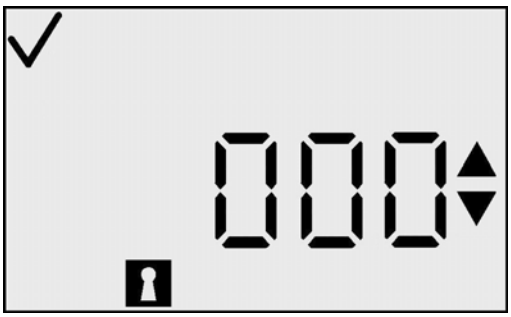
NOTE: The factory default condition for the confidence indicator is "OFF."

NOTE: The backlight of the GasBadge Plus flashes as part of all alarm sequences, except for battery low and the confidence indicator.

Set Security Code

The Set Security Code display is used to change the security code. The default value is 000.

The display will show the present security code value. All characters of the primary display will blink to indicate that the value is ready to change. Momentary presses of the Enter button will increment the security code by one count. Holding the Enter button for an extended period will activate an accelerated number increment. Pressing the Mode button displays the Total Alarm Time screen.



Set Security Code Screen

Actions Available from the Set Security Code Screen

Action	Response
Mode button press	Accept current code, then go to the Total Alarm Time screen
Enter button press	Increment display value
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen
30 second timeout	Go to Gas Monitoring screen

Total Alarm Time

This screen displays the total amount of time that the instrument has been in alarm. The alarm icon, the letters “AT”, and the clock icon are also displayed.

Note that the instrument’s warranty may be affected by the total alarm time. Refer to the Warranty section for more information.

Pressing Mode takes you to the Software Version screen.

Total Alarm Time Screen

Actions Available from the Total Alarm Time Screen

Action	Response
Mode button press	Go to the Software Version screen
Enter button press	No response
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen
30 second timeout	Go to Gas Monitoring screen

Software Version

On this screen, the software version and revision are displayed. The auxiliary display will indicate the software build number as an integer from 0 to 99, preceded by the letter 'b'.

Pressing Mode takes you to the Instrument Test screen.

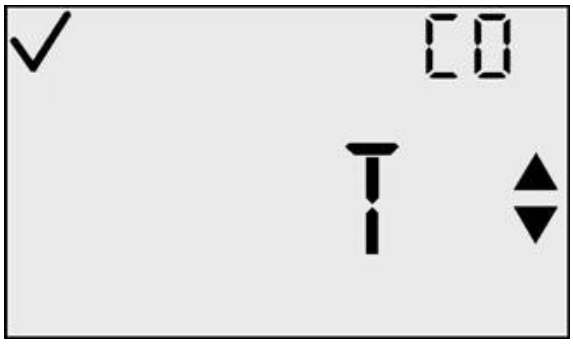
Software Version Screen

Actions Available from the Software Version Screen

Action	Response
Mode button press	Go to Instrument Test screen
Enter button press	No response
Mode and Enter buttons held (3 sec.)	Go to Gas Monitoring screen
30 second timeout	Go to Gas Monitoring screen

Instrument Test Screen

On this screen, you can initiate an instrument test by pressing the Enter button. The instrument test lights all segments of the display for five seconds, and runs an indicator test (similar to the test that is performed at instrument startup). Pressing the Mode button jumps back to the first screen in the Configuration Mode loop.



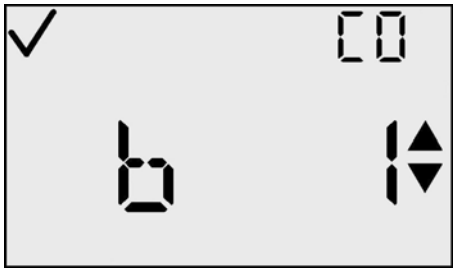
Instrument Test Screen

Actions Available from the Instrument Test Screen

Action	Response
Mode button press	Go to Zero Initiate screen
Enter button press	Go to Test Flash screen (all segments are turned on and each alarm flashes). This screen will time out back to the Instrument Test screen.
Mode and Enter buttons held	Go to Gas Monitoring screen
30 second timeout	Go to Gas Monitoring screen

Bump in Field Option

This screen allows the user to enable the option to perform a bump test in the field. The default setting on this option is 0. When this screen is set to 1, it will allow the "bump" screen to be seen in the normal operating mode. Setting this screen to 1 will also enable further configuration options for enabling the bump due alarm, the bump test interval, and the bump test duration.

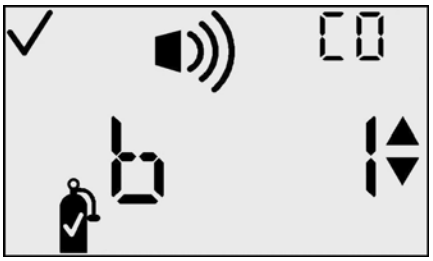


Actions Available from the Bump in Field screen(TCM)

Action	Response
Mode button press	If value = 0, Go to Zero/Calibrate initiate screen. If value = 1, Go to Bump Overdue Alarm screen
Enter button press	Toggle value between 0 and 1. (Default is "0" = Bump in Field disabled
30 second timeout	Go to Gas Monitoring screen.

Bump Overdue Alarm Enable

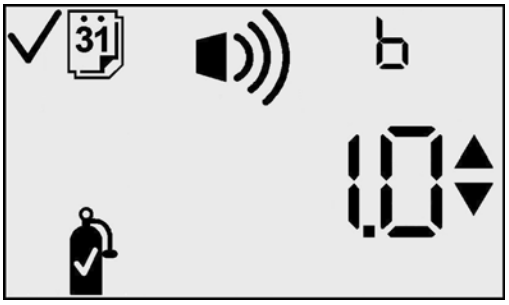
If the bump test option has been enabled, this screen allows the user to enable an alarm that indicates when the instrument is overdue for bump testing. If the bump overdue alarm is enabled, the user will be notified by the appearance of the flashing bump test screen and an audible chirp every 30 seconds.



Actions Available from the Bump Overdue Alarm Screen(TCM)

Action	Response
Mode button press	Go to Bump Test Interval screen
Enter button press	Toggle value between 0 and 1. (Default is "0" = Bump Overdue Alarm disabled
30 second timeout	Go to Gas Monitoring screen.

Bump Test Interval

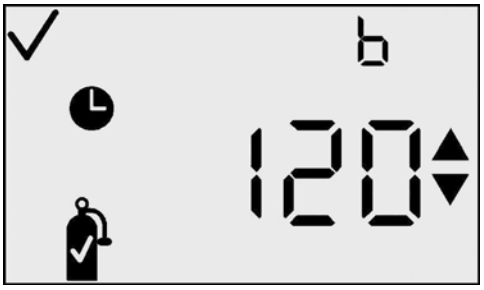


At this screen, the user has the option to set the desired frequency of the bump test before the overdue alarm is activated. This default value is one day and may be set in ½ day increments from ½ day up to 7 days. This will allow the user to ensure that instruments are bump tested twice daily or before two shifts if desired. When the set value has been exceeded without a successful bump test occurring, the overdue alarm described above will be activated.

Actions Available from the Bump Test Interval Screen(TCM)

Action	Response
Mode button press	Go to Bump Test Timeout screen.
Enter button press	Increase value from 0.5 to 7.0 in 0.5 increments. (Default is "1.0" = Bump Test interval is one day
30 second timeout	Go to Gas Monitoring screen.

Bump Test Timeout



This screen allows the user to set the desired length of time for the bump test to take place before failure. The default value of 45 seconds is used and indicates that the instrument will determine that the bump test has failed if a 50% response to the calibration gas concentration is not reached within 45 seconds. This value may be selected in 5 second intervals from 30 seconds to 300 seconds. The bump test period will end when the selected timeout value is reached regardless of whether the test has passed or failed.

Actions Available from the Bump Test Timeout Screen(TCM)

Action	Response
Mode button press	Go to Zero initiate screen.
Enter button press	Increase value from 30 to 300 seconds in 5 second increments.(Default is “45” = Bump Test Timeout is 45seconds.
30 second timeout	Go to Gas Monitoring screen.

Datalink (Optional Accessory)

The GasBadge Datalink is an accessory item that can be used to download the event log to a PC or to setup the instrument. The Datalink is a USB 2.0 device that comes with a software package that can be run on any PC. Before using, USB drivers must be installed from the CD that comes with the Datalink. After the USB drivers are installed, the Datalink user interface software can be installed. Once installed and running, the Datalink software allows users to communicate to either the Datalink Accessory or the Cal Plus™ calibration and bump test station. The software allows users to download the event log from the instrument as well as download and store calibration and bump test records from the Cal Plus.

For more information on Datalink, please contact your local Industrial Scientific sales office or visit our web site at www.indsci.com.

Cal Plus™ Calibration Station (Optional Accessory)

A calibration station is available to bump test and calibrate the GasBadge Plus personal monitor. The Cal Plus™ Calibration Station provides a calibration and bump mechanism that requires minimal user interaction.

The calibration station is designed to work with the GasBadge Plus, as

well as a printer and a PC. **Cal Plus™ Calibration Station**

The communications with the instruments are supported using IrDA through the instrument's infrared communications port. Using this communications port, the calibration station performs bump tests and calibrations of the instrument. The Cal Plus saves the test results and can send the results to a serial printer. The PC-to-Calibration Station communications are done via USB. The printer is connected to the calibration station through an RS232 connection.

For more information on the Cal Plus calibration station, please contact your local Industrial Scientific sales office or visit our web site at www.indsci.com.

DS2 Docking Station (Optional Accessory)

The DS2 Docking Station™ provides the ultimate flexibility for managing gas monitors wherever they are used. Ethernet connectivity enables the linking of up to 700 stand-alone Instrument Docking Stations (IDSs) from remote locations anywhere in a facility and relay the data back to one central database for total instrument management. A graphical user interface tool allows an administrator to view operations on each Docking Station from a network computer, making it easy to track instruments, print reports, set events and change parameters for any location. The DS2 provides all the benefits of consistent automated calibration, record keeping, battery recharging, and instrument diagnostics.

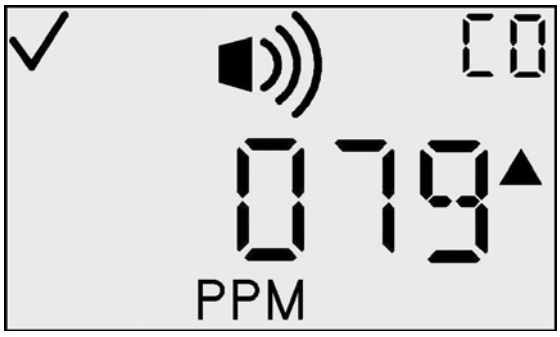
Troubleshooting

Diagnosing Common Problems

Problem	Likely Cause(s)
Display is blank…	• The instrument has not been activated • No power
Unit resets (off/on)…	• Internal error. Unit needs to be serviced.
Unit does not respond to gas…	• Check sensor opening for dirt or debris. • Replace sensor patch. • Calibrate instrument.

Alarm Screen

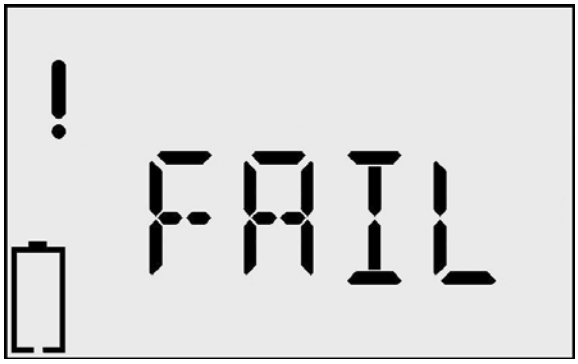
In the presence of a gas concentration that exceeds the low or high level threshold, the instrument will alarm. New alarm detection in any of the instrument's normal operating screens – the battery life, peak, or initiate print screens – will force a transition back to the monitoring screen. An alarm is indicated on the display by the Alarm Indicator and either the Up Indicator or Down Indicator which designate either high or low alarm, respectively.



Sample High Alarm Screen

Battery Failure

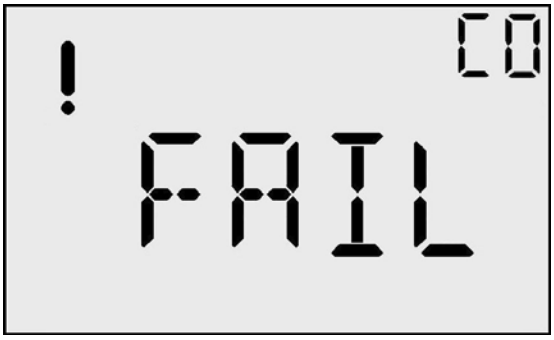
When the instrument reaches the end of its useful life, the word FAIL will appear on the instrument's display and both the audible and visual alarms will be activated; **the unit should be removed from service immediately.** The unit will remain in this alarm state for 10 minutes; during this time, it will no longer detect gas. After 10 minutes in this alarm state, the words "call ISC" will appear on the display and both the audible and visual alarm will cease.



Battery Failure Screen

System Error or Sensor Missing

The GasBadge Plus performs a self-test without initiation from the operator. The self test occurs at intervals of 2 seconds. The self test ensures the presence of the sensor and validates the software process. A system exception is generated if the sensor's presence cannot be confirmed or if an error is detected.



Sensor Missing Error Screen

If the sensor becomes disconnected from the board, the GasBadge Plus enters the Sensor Missing Error screen. The gas type is displayed on the auxiliary readout, the word "FAIL" will be on the primary readout, and the Warning icon will be

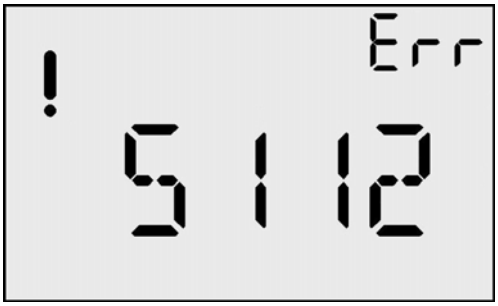
displayed. The entire display blinks. In addition, the instrument will be in a high alarm condition during this state.

From this screen, holding both buttons for 10 seconds allows you to power down the instrument permanently in preparation for returning it to Industrial Scientific for repairs.

WARNING: If this error occurs, you must shut down the personal monitor and return it to Industrial Scientific for servicing. Once the personal monitor is shut down, it cannot be reactivated, until it has been serviced by Industrial Scientific.

Unexpected Instrument Error

The Unexpected Instrument Error screen indicates that an unexpected instrument error has occurred and the instrument will reset. If the error persists, the instrument must be returned to Industrial Scientific for repair or replacement.



Unexpected Error Screen

The instrument is in periodic alarm (one alarm burst every 15 seconds) while in this condition, to attempt to conserve battery life.

Holding both buttons for 10 seconds from this screen allows you to power the instrument down to return it to Industrial Scientific.

WARNING: If this error occurs, you must shut down the personal monitor and return it to Industrial Scientific for servicing. Once the personal monitor is shut down, it cannot be reactivated, until it has been serviced by Industrial Scientific.

Replacing The Sensor Water Barrier/Filter

The sensor in your GasBadge Plus single-gas monitor is protected from liquid and particulate contamination by a gas-permeable PTFE filter membrane. This membrane may become obstructed by dirt, oil or other matter, blocking that pathway of gas to the sensor. An obstructed membrane can be detected by performing a routine "bump test" or calibration of the instrument. Failure of the instrument to respond properly to gas during the test may indicate that the membrane is blocked.

An obstructed filter membrane must be replaced prior to further use of the gas monitor.

To replace the membrane:

- Remove the obstructed membrane from the instrument case-top.
- Remove the new membrane from the adhesive backing.
- Replace the new membrane by adhering it to the sensor opening in the case top as shown.
- Use caution not to excessively rub the membrane with your fingers during replacement as oils from your skin may cause the filter to become obstructed.

For your convenience, one replacement PTFE membrane has been included with your GasBadge Plus. Additional membranes may be ordered from your local supplier of Industrial Scientific products by ordering **P/N 17120643.**

Ordering Information – Accessories and Peripheral Equipment

Part Numbers for the GasBadge Plus and Related Components

Part #	Description	Alarm Setpoints	
		Low	High
18100050-1	GasBadge® Plus with carbon monoxide (CO) sensor	35 ppm	70 ppm
18100050-2	GasBadge® Plus with hydrogen sulfide (H_2S) sensor	10 ppm	20 ppm
18100050-3	GasBadge® Plus with oxygen (O_2) sensor	19.5%	23.5%
18100050-4	GasBadge® Plus with sulfur dioxide (SO_2) sensor	2 ppm	4 ppm
18100050-5	GasBadge® Plus with nitrogen dioxide (NO_2) sensor	3 ppm	6 ppm
17121963	Neck lanyard with safety release		
18106401	Nylon carrying case		
18106419	2-unit nylon carrying case		
17124033	Calibration cup (Cal-Cup)		
18106260	GasBadge Datalink		
18106344-0X[2]	Cal Plus™ Calibration Station		
18106344-1X[2]	Cal Plus™ Calibration Station with on-board dot matrix printer		
17117714	Serial data thermal printer, battery powered		
17117722	Serial data dot matrix printer, 120 VAC powered		
18100701	Calibration gas – carbon monoxide (CO), 100 ppm, 34L		
18104984	Calibration gas – hydrogen sulfide (H_2S), 25 ppm, 34L		
18104976	Calibration gas – nitrogen dioxide (NO_2), 5 ppm, 34L		
18104992	Calibration gas – sulfur dioxide (SO_2), 5 ppm, 34L		
18100271	Calibration gas – oxygen (O_2), 20.9%, 34L		
18103564	34L demand flow regulator for CO and O_2		
18102509	34L demand flow regulator for H_2S, SO_2, and NO_2		

[2] Ordering information: "X" represents the type of power cord, where 0=North American, 1=United Kingdom, 3=European, and 4=Australian.

General Specifications

Item	Description
Case	Rugged polycarbonate shell, with protective concussion-proof overmold. RFI resistant.
Dimensions (H×W×L)	3.2″ × 1.9″ × 1.1″ (81.3 mm × 48.3 mm × 27.9 mm)
Weight	2.5 oz (72 g)
Ingress Protection	Third-party certified IP66/67 (water resistant)
Sensors	O_2, CO, H_2S, SO_2, and NO_2
Measuring Ranges	O_2 range: 0-30% by volume in 0.1% increments CO range: 0-1,500 ppm in 1 ppm increments H_2S range: 0-500 ppm in 0.1 ppm increments SO_2 range: 0-150 ppm in 0.1 ppm increments NO_2 range: 0-150 ppm in 0.1 ppm increments
Display	Custom LCD with graphical icons for easy use. Segmented display for direct gas readings. Backlight for low light conditions. User-selectable option for direct gas reading mode or display just gas type. Peak reading indication.
Alarms	User selectable low and high alarms. Ultra bright LEDs. Loud audible alarm (95 dB). Vibrating alarm.
Event Logger	Continually on. Logs last 15 alarm events, stamping how long ago the event occurred, the duration of the event, and the peak reading seen during the event. Event log can be viewed on PC or printed directly from the instrument to an infrared printer.
Buttons	Two (Mode and Enter)
Battery	Lithium Thionyl-Chloride battery (non-replaceable).
Temperature	Operation: -40º F to 140º F (–40º C to 60º C) Storage: -4º F to 140º F (–20º C to 60º C)
Humidity	0% to 99% RH (non-condensing), typical
Pressure	1 ± 0.1 ATM

Sensor Specifications

The sensors used in this instrument are listed below and operate with the measurement ranges, resolutions, accuracies, temperature ranges, and humidity ranges listed. The accuracies stated below are over the entire operating range of the sensor and defined over the range of calibration.

Sensor Specifications for the GasBadge Plus

Sensor Type	Range	Resolution	% Accuracy[1]		Sensor Temp Range °C (°F)	% RH Range[4]
			Over Cal Range[2]	Over Operating Range[3]		
CO	0 – 1500 ppm	1 ppm	± 5.0	± 15	-40 to +50 (-40 to 122)	15 – 90 %
H_2S	0 – 500 ppm	0.1 ppm	± 5.0	± 15	-40 to +50 (-40 to 122)	15 – 90 %
NO_2	0 – 150 ppm	0.1 ppm	± 5.0	± 15	-20 to +50 (-4 to 122)	15 – 90 %
O_2	0 – 30% vol	0.1%	± 0.5[5]	± 0.8[5]	-20 to +50 (-4 to 122)	0 – 99 %
SO_2	0 – 150 ppm	0.1 ppm	± 5.0	± 15	-40 to +50 (-40 to 122)	15 – 90 %

1 – For any given sensor reading, the accuracy shall be taken to be the greater value of the % value specified below or 1 count.
2 – Within calibration environment range
3 – Over entire operating temperature and %RH range
4 – Non-condensing
5 – Calibrated at 21% Oxygen (O_2)

Agency Certifications

Directive/Code	Approval / Specification Information	Standard
UL/cUL	Class I, Groups A, B, C, D T4; Class II, Groups E,F,G; Class I, Zone 0, AEx ia IIC T4	UL 913 7th Ed. UL 60079-0 5th Ed. UL 60079-11 5th Ed. CSA C22.2 No. 157 3rd Ed.
CSA	Ex ia IIC T4	--
ATEX	Ex ia I Ma / Ex ia IIC T4 Ga; IP64 Equipment Group and Category: I/II 1G/M1	EN 60079-0: 2009 EN 60079-11: 2007 EN 60079-26: 2007 EN 50303: 2000
Australia	Ex ia I/IIC T4	--
IECEx	Ex ia IIC T4 Ga; IP64	IEC 60079-0: 2007 IEC 60079-11: 2006 IEC 60079-26: 2006
MSHA	Intrinsically safe for methane/air mixtures only	CFR 30, Part 18

Warranty

The GasBadge Plus version 3.0 has a battery life expectancy of 12 months and will automatically shutdown 12 months after activation. Therefore, the product carries a 1 year warranty.

Limitation of Liability

Industrial Scientific makes no other warranties, either expressed or implied, including but not limited to the warranties of merchantability or fitness for particular purpose.

Should the product fail to conform to the above warranty, buyer's only remedy and Industrial Scientific's only obligation shall be, at Industrial Scientific's sole option, replacement or repair of such non-conforming goods or refund of the original purchase price of the non-conforming goods.

In no event will Industrial Scientific be liable for any other special, incidental or consequential damages, including loss of profit or loss of use, arising out of the sale, manufacture or use of any products sold hereunder whether such claim is pleaded in contract or in tort, including strict liability in tort.

It shall be an express condition to Industrial Scientific's warranty that all products be carefully inspected for damage by Buyer upon receipt, be properly calibrated for Buyer's particular use, and be used, repaired, and maintained in strict accordance with the instructions set forth in Industrial Scientific's product literature. Repair or maintenance by non-qualified personnel will invalidate the warranty, as will the use of non-approved consumables or spare parts.

As with any other sophisticated product, it is essential and a condition of Industrial Scientific's warranty that all personnel using the products be fully acquainted with their use, capabilities and limitations as set forth in the applicable product literature. Buyer acknowledges that it alone has determined the intended purpose and suitability of the goods purchased.

It is expressly agreed by the parties that any technical or other advice given by Industrial Scientific with respect to the use of the goods or services is given without charge and at Buyer's risk; therefore, Industrial Scientific assumes no obligations or liability for the advice given or results obtained.

Ex-Ox-Tox Gasdetectie
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E-mail: info@exoxtox.nl
Website: www.exoxtox.nl

INDUSTRIAL SCIENTIFIC

MANUFACTURER DECLARATION OF CONFORMITY

Déclaration de Conformité Constructeur

CE

The company **Industrial Scientific Corporation**, Oakdale, Pennsylvania USA, declares that the following new material intended for use in Explosive Atmospheres:
*(La société **Industrial Scientific Corporation**, Oakdale, Pennsylvania USA, atteste que le matériel neuf destiné à être utilisé en Atmosphères Explosives désigné ci-après :)*

Gas detector *(Détecteur de gaz)* GasBadge Plus

comply with the requirements of the following European Directives :
(est conforme aux exigences des Directives Européennes suivantes:)

I) The European Directive ATEX 94/9/CE of 23/03/94: Explosive Atmospheres
Directive Européenne ATEX 94/9/CE du 23/03/94 : Atmosphères Explosives

No. of EC type examination certificate: *(N° Attestation CE de Type du matériel:)*	**DEMKO 09ATEX 0844098**
Issued by the Notified Body no. 0539: *(Délivrés par l' Organisme notifié sous le numéro 0539)*	UL International DEMKO A/S, LYSKEAR 8 P.O. Box 514, DK – 2730, HERLEV, DENMARK

Reference European Standards *(Normes européennes de référence)*:

Rules of construction *(Règles de construction)* :	EN 60079-0:2009, EN 60079-11:2007, EN 60079-26:2007, EN 50503:2000
Category *(Catégorie)* :	Ⓔx II 1G / I M1 Ex ia IIC T4 Ga / Ex ia I Ma Tamb: -40°C to +60°C

Production Quality Assurance Notification No. of the Oakdale factory SIRA 00 ATEX M0080
(N° de la Notification Assurance Qualité de Production de l'usine de Oakdale)

Issued by the Notified Body no. 0518: *(Délivrés par l'Organisme notifié sous le numéro 0518)*	SIRA Certification Services, Rake Lane Eccleston, Chester CH4 9JN, UK

II) The European Directive EMC 89/336/CEE of 3/05/89: Electromagnetic Compatibility
Directive Européenne CEM 89/336/CEE du 3/05/89 : Compatibilité Electromagnétique

Harmonised applied standards: *(Normes harmonisées appliquées)*	EN 50270

On behalf of the manufacturer
Pour le fabricant

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La Personne Autorisée ATEX

Scott Lordo
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Directeur Technique

ISO 9001:2000 CERTIFIED

CE/ATEX/Oak/0804 rev d

OUR MISSION

Preserving human life on, above and below the earth
Delivering highest quality, best customer service ...
every transaction, every time

ISO 14001:2004 CERTIFIED

Oakdale, PA, October 2010