

calibration gas through the CAL. GAS fitting on the back of the station during a bump test.

Bump Test Check Tolerance (cHE)

The bump test check tolerance only applies to bump testing. It determines how close the GX-2009 gas reading must be to the calibration gas concentration for each channel during a bump test in order to pass the bump test. It is defined as a percentage of the calibration gas concentration. The amount that the GX-2009 gas reading differs from the calibration gas concentration must be equal to or less than this percentage of the calibration gas concentration. For example, if the tolerance is set to 50%, and the %LEL calibration gas concentration is 50% LEL, then the bump test gas reading for the LEL channel on the GX-2009 must be $50\% \text{ LEL} \pm 25\% \text{ LEL}$.

Automatic Calibration (cAL)

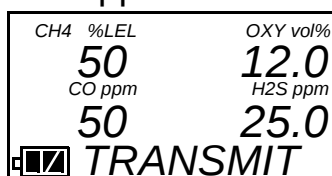
Automatic calibration only applies to bump testing. It is set to on or off. If it is set to on, then the calibration station will automatically perform a calibration if a bump test fails.

Turning On the SM-2009U with a GX-2009

Do the following to turn on the SM-2009U and establish a connection with a GX-2009:

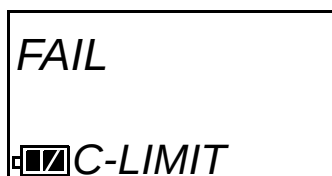
1. Confirm that the AC Adapter is connected to the SM-2009U and to an AC wall socket.
2. Press and hold the SM-2009U's POWER button. The LEDs will turn amber the internal pump will turn on momentarily.
3. When the pump stops and the BUMP and CAL. LEDs turn off, release the POWER button.
4. The COPY LED will be off or on steadily and the CHARGE LED will be blinking green if the SM-2009U is operating properly or solid red if there is a system failure. The amount of free memory in the SM-2009U will dictate the condition of the COPY LED (see "Available Memory in the SM-2009U" on page 37).

5. Install a GX-2009 in the instrument cradle. The CHARGE LED will begin to blink yellow. See “Charging an Instrument in a Calibration Station” on page 35 for a complete description of charging the GX-2009.
6. Press and hold the POWER MODE button on the GX-2009 until you hear a beep, then release it. The GX-2009 will begin its power up sequence (see exceptions below in step 7). If a successful connection between the GX-2009 and the SM-2009U occurs, the TRANSMIT screen will appear on the GX-2009 display.



NOTE: The screen shown above applies to a 4-channel GX-2009. If your GX-2009 has less than 4 channels, the inactive channels will not appear in the above screen and in any screens where channels are displayed. All screens in this manual assume a 4-channel GX-2009.

7. There are two exceptions to the sequence described in step 6 above. See the GX-2009 User Setup Program Operator’s Manual for a description of the **Cal Limit Display** and **Cal Limit Check** instrument parameters.
 - When **Cal Limit Display** is set to *On* and **Cal. Limit Check** is set to *Can’t Use*, if the GX-2009 is due for calibration the instrument will show a calibration expired failure screen and the buzzer and LED arrays will pulse for a few seconds before connecting to the SM-2009U.



The failure screen will remain on the display while the unit is connected to the SM-2009U and it is not possible to view or set the bump test or calibration parameters.

NOTE: You can still use the SM-2009 with an instrument for bump testing and calibration if this failure indication occurs, but you will not be able to perform any operations that require the display until a calibration is performed, the unit is turned off, and then the unit is re-connected to the SM-2009U. If you perform a bump test or calibration in this case, the only indication of pass or fail will be the BUMP or CAL. LED.

- When **Cal Limit Display** is set to *On* and **Cal. Limit Check** is set to *Confirm to use*, if the GX-2009 is due for calibration the unit will show the following screen and beep and flash the LED arrays for a few seconds indicating that calibration is due.

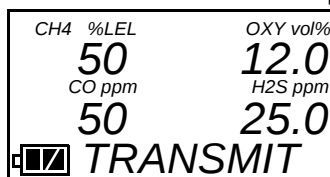


When the beeping and flashing stops, press and release the POWER MODE button on the GX-2009 to continue. The unit will now connect to the SM-2009U, the TRANSMIT screen shown in step 6 above will be displayed, and the CHARGE LED will begin to blink green.

Setting the Bump Test Parameters

Do the following to set the bump test parameters after establishing a connection between a GX-2009 and the SM-2009U.

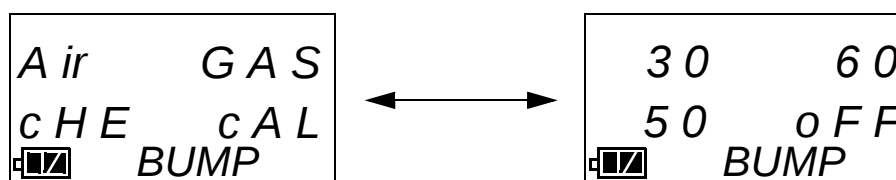
1. Turn on the SM-2009U with a GX-2009 and establish a connection between them as described above in "Turning On the SM-2009U with a GX-2009". The GX-2009 will display the TRANSMIT screen.



2. Press and release the EDIT ENTER button. The GX-2009 will display the following screen.

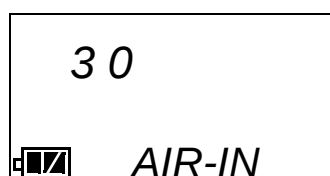


3. Press and release the BUMP ▼ button. The GX-2009 will display the following screens alternating between the four bump test parameters and their settings.

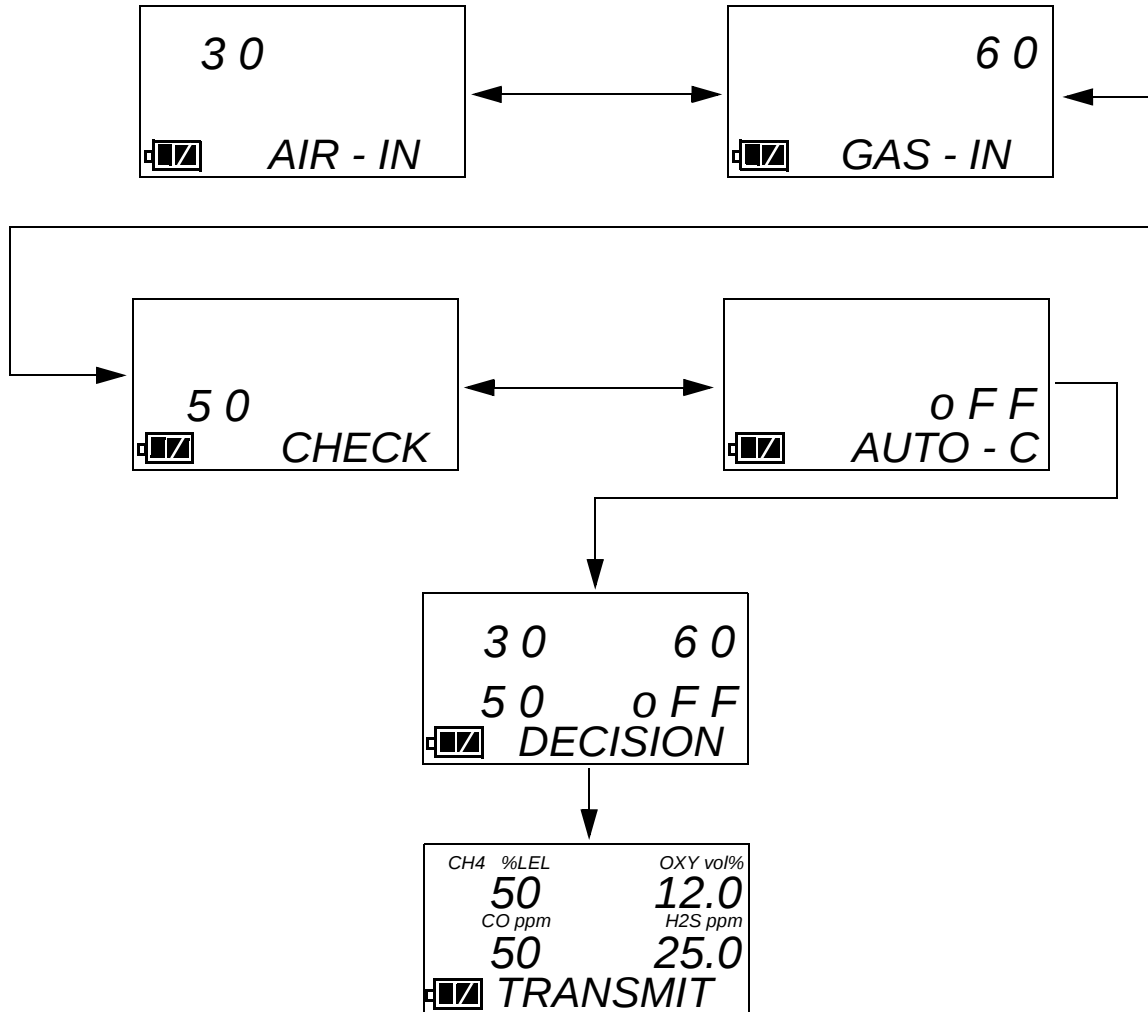


4. If you wish to cancel setting the bump test parameters or were just viewing the parameters to confirm their values, press and release the BUMP ▼ button to return to the TRANSMIT screen.

To continue and change parameters, press and release the EDIT ENTER button. The first bump test parameter, air sample time, will be shown on the GX-2009 display.



- Use the BUMP ▼ and CAL. ▲ buttons to scroll through the parameters until the desired parameter is displayed. The scrolling sequence is shown below. Do not scroll past AUTO-C until you have finished making any desired changes.



- With the desired parameter displayed, press and release the EDIT ENTER button. An “E” will appear on the GX-2009 display to the right of the battery icon indicating that the parameter value can be changed. In the example below, the GAS-IN parameter has been selected for updating.

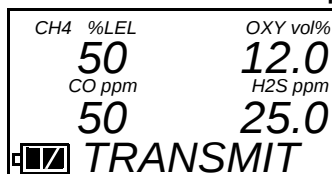


7. Use the BUMP ▼ and CAL. ▲ buttons to set the parameter to the desired value, then press and release the EDIT ENTER button. The “E” next to the battery icon will disappear.
8. Repeat step 5 - step 7 to set any other parameters.
9. When you are done setting the parameters, use the BUMP ▼ button to scroll past AUTO-C. The DECISION screen will appear momentarily to indicate that the parameter changes have been saved and then the GX-2009 will return to the TRANSMIT screen.

Setting the Calibration Parameters

Do the following to set the calibration parameters after establishing a connection between a GX-2009 and the SM-2009U.

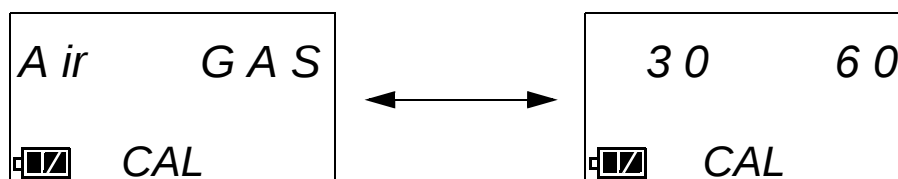
1. Turn on the SM-2009U with a GX-2009 and establish a connection between them as described above in "Turning On the SM-2009U with a GX-2009". The GX-2009 will display the TRANSMIT screen.



2. Press and release the EDIT ENTER button. The GX-2009 will display the following screen.

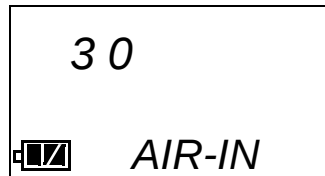


3. Press and release the CAL. ▲ button. The GX-2009 will display the following screens alternating between the two calibration parameters and their settings.

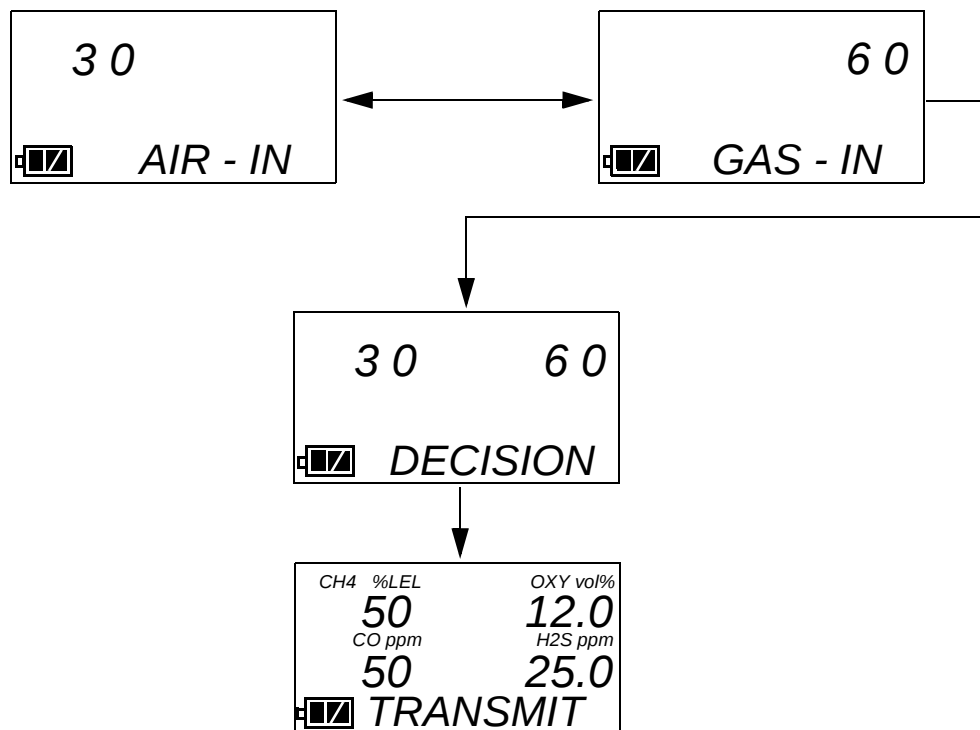


4. If you wish to cancel setting the calibration parameters or were just viewing the parameters to confirm their values, press and release the CAL. ▲ button to return to the TRANSMIT screen.

To continue, press and release the EDIT ENTER button. The first parameter, air sample time, will be shown on the GX-2009 display.



5. Use the BUMP ▼ and CAL. ▲ buttons to scroll through the parameters until the desired parameter is displayed. The scrolling sequence is shown below. Do not scroll past GAS-IN until you have finished making any desired changes.



6. With the desired parameter displayed, press and release the EDIT ENTER button. An “E” will appear on the GX-2009 display to the right of the battery icon indicating that the parameter value can be changed. In the example below, the GAS-IN parameter has been selected for updating.



7. Use the BUMP ▼ and CAL. ▲ buttons to set the parameter to the desired value, then press and release the EDIT ENTER button. The “E” next to the battery icon will disappear.
8. Repeat step 5 - step 7 to set any other parameters.
9. When you are done setting the parameters, use the BUMP ▼ button to scroll past GAS-IN. The DECISION screen will appear momentarily to indicate that the parameter changes have been saved and then the GX-2009 will return to the TRANSMIT screen.

Connecting Calibration Gas

The CAL. GAS fitting on the back of the calibration station is designed to be used with a calibration gas cylinder that is fitted with a demand flow regulator. The AIR fitting may be used with a demand flow regulator and a cylinder of zero emissions air, but this is not normally necessary since the calibration station will generally be in a fresh air area.

The type of calibration gas cylinder used depends on the gas sensors installed in the GX-2009 being used with the calibration station. A 4-gas mix, LEL/Oxygen/CO/H₂S, is used if the instrument being used with the calibration station is a 4-gas unit. If the instrument does not have an H₂S channel, then a 3-gas mix, LEL/Oxygen/CO, is used. Although a 4-gas cylinder will work for an instrument of any gas combination, if you have multiple instruments with various gas combinations, you may want to keep a 4-gas cylinder and a 3-gas cylinder to help preserve the charcoal filter on the CO sensor in instruments without an H₂S channel. Use Table 4 below as a guide in determining which calibration gas cylinder is appropriate for your system. See “Spare Parts List” on page 50 for a list of available cylinder part numbers.

Table 4: Recommended Gas Cylinders

Typical Instrument Types	Recommended Calibration Gas Cylinder
LEL/Oxy/H ₂ S/CO	4-gas mix with LEL/Oxy/H ₂ S/CO
LEL/Oxy/CO	3-gas mix with LEL/Oxy/CO
LEL/Oxy/H ₂ S	4-gas mix with LEL/Oxy/H ₂ S/CO
LEL/Oxy	3-gas mix with LEL/Oxy/CO

Table 4: Recommended Gas Cylinders

Typical Instrument Types	Recommended Calibration Gas Cylinder
Oxy/CO	3-gas mix with LEL/Oxy/CO
Oxy/H ₂ S	4-gas mix with LEL/Oxy/H ₂ S/CO

To connect calibration gas to the SM-2009U do the following:

1. If the area around the calibration station is not considered a fresh air area (an area free of combustible and toxic gases and of normal oxygen content, 20.9%) install a tube not longer than 10 feet on the filter attached to the AIR fitting on the back of the docking station and route it to a fresh air area or connect a cylinder of zero air with a demand flow regulator to the fitting.
2. Install the demand flow regulator on the calibration gas cylinder.
3. Connect the demand flow regulator to the CAL. GAS port using the 3 foot length of 3/16" ID sample tubing provided with the station.

Installing the Single Module Data Viewer Software

1. Launch Windows®.
2. Exit from all applications and open windows.
3. Insert the Single Module Data Viewer Software Installation CD into your computer's CD-ROM drive.
4. The Single Module Data Viewer InstallShield Wizard comes up to guide you through installation. Click **Next** to proceed to the License Agreement window.
5. Read the license agreement and click the agreement acceptance selection box, then click **Next** to proceed to the Customer Information window.
6. Enter a user name and organization and select if you want to install the program for all users on the computer or just for your user account, then click **Next** to proceed to the Destination Folder window.
7. The default installation folder (C:\Program Files\Single Module Data Viewer\) is displayed. If you want to install the software in the default folder continue with step 8. If you want to install the software in a different location, click **Change** and choose a new installation folder now and then continue with step 8.
8. Click **Next** to proceed to the Ready to Install the Program window.
9. Review the installation settings. If they are Ok, click **Install** and the installation process will begin. If you want to change installation settings, click **Back** and change them to the desired settings.
10. During software installation, the installation program may find newer versions of Windows files on your computer than those in the Installation CD. If this happens, the installation software will ask you if you want to keep these newer files. Click **Yes** to do so.
11. Follow the on-screen instructions to complete software installation.

Chapter 4: Using the SM-2009U

Overview

When you have completed the tasks in "Chapter 3: Preparing to Use the SM-2009U", you are ready to use the SM-2009U calibration station. The SM-2009U is capable of performing bump tests and calibrations on the GX-2009. It can also charge the rechargeable batteries in the GX-2009. This chapter describes procedures for using the calibration station to bump test, calibrate, and recharge GX-2009s. It also describes the information that is saved in a calibration station's memory and how to save that information to a USB flash drive.

Bump Testing Instruments

When a bump test is performed, the SM-2009U performs a fresh air adjustment on a GX-2009 and then applies calibration gas to the instrument. The station then analyzes the response results based on criteria defined by the bump test check tolerance parameter and determines if the instrument passed the bump test. The bump test check tolerance is defined in "Bump Test Check Tolerance (cHE)" on page 15. If the automatic calibration parameter is set to on, then the SM-2009U will automatically perform a calibration if the bump test fails.

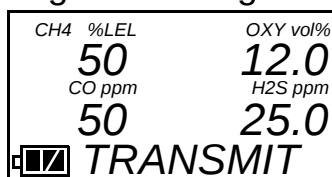
Do the following to perform a bump test

1. Confirm that the AC Adapter is connected to the SM-2009U and to an AC wall socket.
2. Press and hold the SM-2009U's POWER button. The LEDs will turn amber the internal pump will turn on momentarily.
3. When the pump stops and the BUMP and CAL. LEDs turn off, release the POWER button.
4. The COPY LED will be off or on steadily and the CHARGE LED will be blinking green if the SM-2009U is operating properly or solid red if there is a system failure. The amount of free memory in the SM-2009U will dictate the condition of the COPY LED (see "Available Memory in the SM-2009U" on page 37).
5. Install a GX-2009 in the instrument cradle. The CHARGE LED will

begin to blink yellow. If the batteries are fully charged, the CHARGE LED will become solid green after about 5 minutes. Typically a bump test or calibration will be initiated before this happens. See “Charging an Instrument in a Calibration Station” on page 35 for a complete description of charging the GX-2009.

NOTE: If the GX-2009 is left in the SM-2009U after calibration or bump testing, the pump will run for 12 seconds every 2 minutes in order to keep hydrogen generated from charging of the NiMH batteries from affecting the CO sensor.

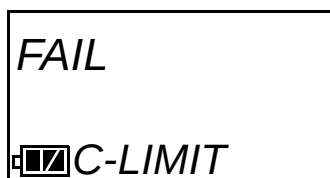
6. Press and hold the POWER MODE button on the GX-2009 until you hear a beep, then release it. The GX-2009 will begin it's power up sequence (see exceptions below in step 7). If a successful connection between the GX-2009 and the SM-2009U occurs, the TRANSMIT screen will appear on the GX-2009 display and the CHARGE LED will begin to blink green.



NOTE: The screen shown above applies to a 4-channel GX-2009. If your GX-2009 has less than 4 channels, the inactive channels will not appear in the above screen and in any screens where channels are displayed. All screens in this manual assume a 4-channel GX-2009.

7. There are two exceptions to the sequence described in step 6 above. See the GX-2009 User Setup Program Operator's Manual for a description of the **Cal Limit Display** and **Cal Limit Check** instrument parameters.
 - When **Cal Limit Display** is set to *On* and **Cal. Limit Check** is set to *Can't Use*, if the GX-2009 is due for calibration the instrument will show a calibration expired failure screen and the buzzer and LED arrays will pulse for a few seconds before

connecting to the SM-2009U.



The failure screen will remain on the display while the unit is connected to the SM-2009U.

NOTE: You can still use the SM-2009 with an instrument for bump testing and calibration if this failure indication occurs, but you will not be able to perform any operations that require the display until a calibration is performed, the unit is turned off, and then the unit is re-connected to the SM-2009U. If you perform a bump test or calibration in this case, the only indication of pass or fail will be the BUMP or CAL. LED.

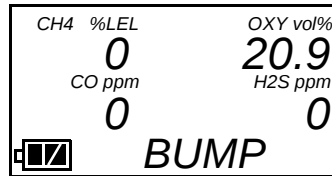
- When **Cal Limit Display** is set to *On* and **Cal. Limit Check** is set to *Confirm to use*, if the GX-2009 is due for calibration the unit will show the following screen and beep and flash the LED arrays for a few seconds indicating that calibration is due.



When the beeping and flashing stops, press and release the POWER MODE button on the GX-2009 to continue. The unit will now connect to the program, the TRANSMIT screen shown in step 6 above will be displayed, and the CHARGE LED will begin to blink green.

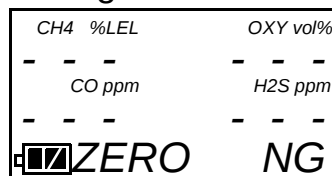
8. If necessary, confirm that the bump test check tolerance is set to the desired value. See “Setting the Bump Test Parameters” on page 17
9. Verify that the appropriate calibration gas cylinder is connected to the CAL. GAS fitting on the back of the SM-2009U. See “Connecting Calibration Gas” on page 22 for calibration gas cylinder options and calibration gas connection procedures.

10. Press and hold the BUMP ▼ button for at least one second, then release it. The bump test begins. During the bump test, the BUMP LED will flash yellow indicating that a bump test is in progress and the GX-2009 display will show the current gas readings.



11. The SM-2009U will apply fresh air to the instrument for the time defined by the air sample time parameter.
12. The SM-2009U will perform a fresh air adjustment on the instrument.
13. If the air adjustment is successful, the SM-2009U will continue as described in step 14 below.

If one or more of the sensors fails the fresh air adjustment, then the SM-2009U will abort the bump test and will not apply calibration gas. If this happens, the BUMP LED will turn steadily red indicating a failure and the following screen will appear.



In this case, you may attempt another bump test, press and release the EDIT ENTER button to return to the TRANSMIT screen, or turn off the GX-2009 using the EDIT ENTER and POWER buttons.

14. The SM-2009U will apply calibration gas to the instrument for the time defined by the calibration gas sample time parameter. At the end of the calibration gas application, the SM-2009U will determine if the bump test passed, but will not yet show the results.
15. If the automatic calibration bump test parameter is set to off or if it set to on and the bump test passes, the SM-2009U will purge the system with fresh air for the time defined by the air sample time parameter.

If the automatic calibration parameter is set to on and the instrument failed the bump test, the SM-2009U will continue to

apply gas and perform a calibration.

16. The BUMP LED will stop blinking and be on steadily green if the bump test passed or steadily red if the bump test failed.
17. If the automatic calibration parameter is set to on and the instrument failed the bump test prompting an automatic calibration, the CAL. LED will be on steadily green if the calibration passed or steadily red if the calibration failed.
18. In addition to the indication by the BUMP LED and, if an automatic calibration took place, the CAL. LED, the GX-2009 display will indicate the bump test result or bump test/calibration result for each channel by alternating between two screens. One screen indicates whether each channel passed or failed and one screen indicates the bump test gas reading for each channel if only a bump test was performed or the calibration settings if a bump test and calibration were performed. A “P” indicates a pass and a “F” indicates a fail. Two examples of possible outcomes are shown below for both a bump test only and for a bump test with a calibration.

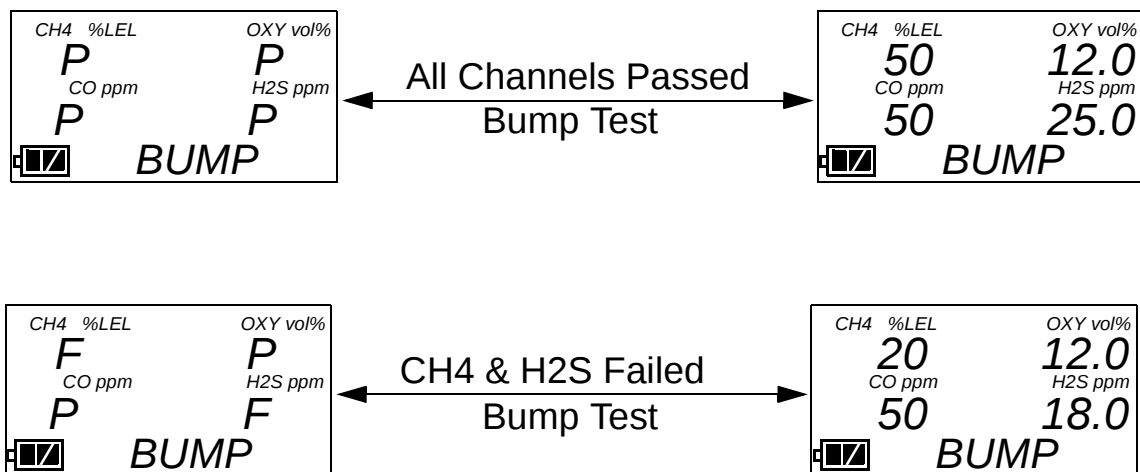


Figure 7: Screen Indications for Bump Test Only

If a successful bump test is performed, the GX-2009 will automatically be shut off in 15 seconds. The bump test due date will also be reset in the GX-2009.

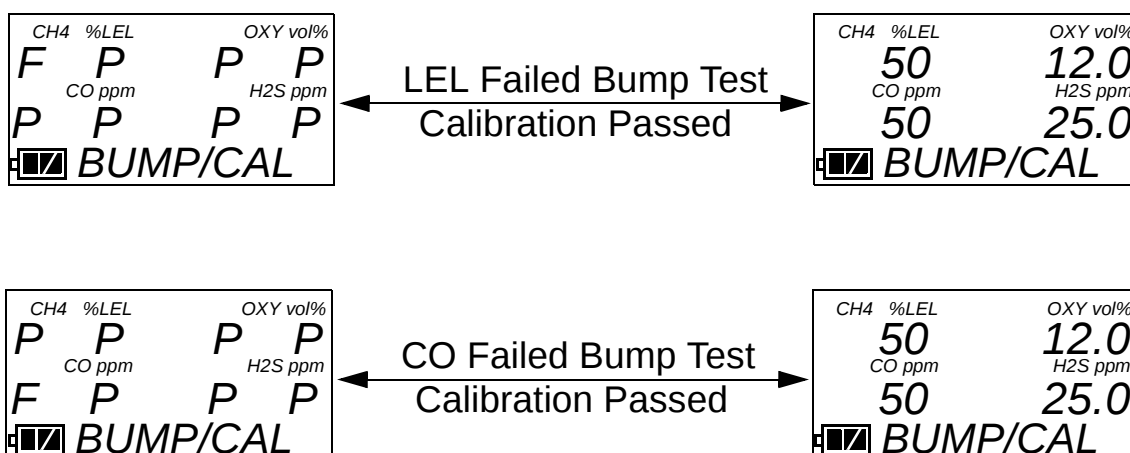


Figure 8: Screen Indications for Bump Test & Automatic Calibration

19. The results of the bump test or bump test and calibration will be stored in the SM-2009U's memory and will be available to copy to a USB flash drive. See "Copying Calibration and Bump Test Records to a USB Flash Drive" on page 37 for instructions to copy the saved bump test and calibration records to a USB flash drive.
20. If you wish to return to the Transmit screen, press and release the EDIT ENTER button. If not, continue with step 21.
21. Turn off the instrument by pressing and holding the EDIT ENTER and POWER buttons simultaneously for at least one second and then releasing them. If no control buttons are pressed for 10 minutes, the SM-2009U will automatically turn off the instrument.

CAUTION: When using the GX-2009 with the SM-2009U, do not turn off the instrument using the instrument power switch. Use the EDIT ENTER and POWER buttons on the SM-2009U to turn off the instrument.

22. Remove the GX-2009 from the SM-2009U.
23. If you wish to bump test additional instruments, repeat step 5 - step 22 above for each additional instrument.

Calibrating Instruments

When a calibration is performed, the calibration station performs a fresh air adjustment on an instrument and then applies calibration gas to the instrument. The calibration station analyzes the calibration results and determines if the instrument passed the calibration.

To perform a calibration on an instrument:

1. Confirm that the AC Adapter is connected to the SM-2009U and to an AC wall socket.
2. Press and hold the SM-2009U's POWER button. The LEDs will turn amber the internal pump will turn on momentarily.
3. When the pump stops and the BUMP and CAL. LEDs turn off, release the POWER button.
4. The COPY LED will be off or on steadily and the CHARGE LED will be blinking green if the SM-2009U is operating properly or solid red if there is a system failure. The amount of free memory in the SM-2009U will dictate the condition of the COPY LED (see "Available Memory in the SM-2009U" on page 37).
5. Install a GX-2009 in the instrument cradle. The CHARGE LED will begin to blink yellow. If the batteries are fully charged, the CHARGE LED will become solid green after about 5 minutes. Typically a bump test or calibration will be initiated before this happens. See "Charging an Instrument in a Calibration Station" on page 35 for a complete description of charging the GX-2009.
6. Press and hold the POWER MODE button on the GX-2009 until you hear a beep, then release it. The GX-2009 will begin it's power up sequence (see exceptions below in step 7). If a successful connection between the GX-2009 and the SM-2009U occurs, the TRANSMIT screen will appear on the GX-2009 display and the CHARGE LED will begin to blink green.

