Amerex Owner’s Manual

AMGaDS III Plus

Amerex Two Zone Mobile Gas Detection System

Includes test procedure required for California vehicles and “exemption letter”

ENP-116
Rev. B March 2016
**Proprietary Statement**

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This document includes notes from the Amerex 20188 AMGaDS III Calibration Kit. Check with your authorized Amerex dealer for the latest information.

1. **Notes for California Vehicles Only**

Liquefied natural gas (LNG) fuel system vehicles in California must comply with CA Code of Regulations (13 CCR Section 935 (b) (2)), which requires the following:

- Every motor vehicle equipped with an LNG fuel system shall be equipped with a methane gas detection system which shall warn of the presence of methane in the engine compartment, driver's compartment and any passenger compartments.
- At a minimum, the methane gas detection system shall provide a warning before the methane gas concentration reaches 25% of the Lower Flammability Limit. Such warning shall be plainly audible and visible to the driver before entering the driver's compartment and while seated in the normal driving position.
- The gas detection system shall function continuously at all times, whether or not the engine is operating, when the vehicle is operated or parked on public roadways or other areas open to the public.
- At a minimum, the gas detection system shall be tested three times per calendar year at equal intervals. The testing procedure shall simulate the same gaseous fuel and operating environment in which the vehicle is used.
- Test results, validating the performance of the gas detection system within the parameters established by the component manufacturer(s), shall be maintained as a permanent part of the vehicle service history records.

In addition to the above, the California Highway Patrol will be adopting a requirement for the testing of two stages of flammability warning, the first at a range of 20 percent to 30 percent and the second stage at a range of 50 percent and 60 percent. A letter explaining these requirements is attached at the end of
this document. A copy of the letter is to be carried in the vehicle and a copy is to be kept on file with the vehicle maintenance records. The letter must be presented to any inspecting officer if requested.

When properly installed, the Amerex AMGaDS III two zone system meets the requirements. For methane detector testing, the Amerex 20188 Calibration Kit may be used to comply with requirements.

![Image 1](image1.png)
![Image 2](image2.png)

*Figure 1 The Amerex part number 20188 Calibration Kit may be used to test the methane detection system for LNG-fueled vehicles in California.*

The Amerex 20188 Calibration Kit can be purchased from an authorized Amerex dealer or distributor.

## 2. Test Procedure Notes – California Only

The methane detection system or components (sensors, control panel, wiring) must not be removed from the vehicle, since the methane detection system inspection and test “. . . shall simulate the same gaseous fuel and operating environment in which the vehicle is used.”

### 2.1 Sensor Inspection – Visual

1. Check each sensor membrane under the end cover to make sure it is not covered with dust, oil, grease or other debris.
2. Make sure all cables and connectors are clean and are not kinked or abraded.
3. Make sure the sensors and connecting cables are properly clipped and support the sensor securely.

### 2.2 System Test for Gas Levels – Lower Limit Testing, 25 Percent Methane

Test the two sensors with 25 percent methane gas first. When using the calibration test kit, **DO NOT** press the control panel “Push to Test” button.
Figure 2 Typical Zone 1 sensor location. Visible in this picture is the two-zone control panel (1), warning buzzer (2), sensor (3) and warning lights (4, 5). The low temperature warning light at the bottom right is not part of the methane detection system.

1. Remove the sensor from Zone 1 (usually in the cab) from its P-clip, but leave the wire harness connected.
2. Connect the regulator to the cylinder of 25 percent methane test gas.
3. Connect the length of plastic tubing to the regulator and the other end to the gas calibration adaptor assembly.
4. Push the adaptor onto the sensor.
5. Open the valve.
6. The trace light for Zone 1 should begin to flash within about one minute.

Figure 3 If the TRACE light flashes when exposed to the 25 percent test gas, the system passes for the zone under test. If the trace light does not flash – replace the sensor and repeat the test.

7. If the trace light does not flash, the sensor is defective and must be replaced.
   a. Turn off the gas, remove and replace the sensor.
b. Repeat the test.

8. When the one minute test is complete, turn off the gas, remove the calibration adaptor and re-install the sensor.

9. Repeat the test with the Zone 2 sensor. The Zone 2 sensor is usually located in the engine compartment.

2.3 System Test for Gas Levels – Upper Limit Testing, 55 Percent Methane

Perform steps 1 through 6 for each sensor as described above, using the 55 percent LEL test gas, and then following additional steps:

1. After five to seven more seconds, the significant light should flash and the audible alarm should sound.

2. If the Sensor Fault lights, turn off the gas, and check the wiring.

3. Turn the gas on, and repeat the test.

4. If the Sensor Fault lights, replace the sensor and repeat the test.

5. This completes the test for Zone 1.
   a. Turn off the gas, remove the calibration adaptor and re-install the sensor.
6. Repeat the procedure for Zone 2.

3. Test Procedure Notes – Non-California

For all other vehicles, an operational check and alarm demonstration can be used, twice per year. The detector manufacturer has the following recommendations:

3.1 Test Sensors and Display Module Twice a Year

1. The sensors and cables should remain on the vehicle. No need to remove anything.
2. Verify the membrane at the end of the sensor is intact and not covered by dirt, oil, grease or other contaminants.
3. Cables and connectors should be clean and intact.
4. Make sure the sensor and wire harness are securely mounted.
5. To test the display module, push the test button.
6. To test a sensor, expose it to a two second stream of unburned butane from a butane cigarette lighter, and verify the display panel indicates a SIGNIFICANT alarm.
7. Repeat this test for each sensor.

Attachment: California Highway Patrol Exception Letter

File name: CHP Exemption 7-6-09 (2) (2).pdf

A copy of the letter is to be carried in the vehicle and a copy is to be kept on file with the vehicle maintenance records. The letter must be presented to any inspecting officer if requested.

Table 1 Revision Level

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OWNER’S MANUAL
P/N 16531

AMGaDS III Plus
Amerex Two Zone Mobile Gas Detection System

Manufactured by:
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Phone:  (205) 655-3271
fax:  (205) 655-3279
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AMGaDS III Two Zone System Features

- Dual Sensor Capability
- Low Maintenance
- Solid State Sensors
- Self Testing Circuitry
- Low Power Consumption
- Multi Level Alarms
- Remote Alarm Capability
- Internal Auxiliary Relay

AMGaDS III Plus Display Panel P/N 16528

READ THIS MANUAL CAREFULLY AND SAVE FOR FUTURE REFERENCE. KEEP THIS MANUAL WITH THE AMGADS III SYSTEM.
Introduction

The AMGaDS III vapor monitoring system utilizes advanced technology for detection of propane (LPG), CNG (Compressed Natural Gas), LNG (Liquid Natural Gas), and any other hydrocarbon fuel vapors. The AMGaDS III allows connection of two (2) sensors and has both visual and audible alarms at Trace and Significant gas concentration levels. Test buttons are provided for full checking of all operations. System operation and correct sensor operation are continually monitored and indicators are provided for fault detection. In addition, the AMGaDS III Plus has an internal relay for automatic control of auxiliary devices. Read this owner’s manual completely before installation. Failure to read and follow these instructions can result in damage to the unit voiding the warranty.

System Components:

- One AMGaDS III Control Panel complete with one 68 inch modular power connection and 18 inch relay connection lead.
- Two sensor cables. Available in 10 foot (3 meter), 20 foot (6 meter), 35 foot (11 meter), 50 foot (15 meter), 65 foot (20 meter), 85 foot (26 meter) or 100 foot (30 meter) lengths. See page 9 for list of part numbers.
- Two AMGaDS III Solid State Gas Sensors with mounting clamps.

CAUTION: No Power On/Off switch is provided for this unit. To function as intended, the AMGaDS III must be connected to a correct power source, and for maximum effectiveness, be powered at all times. If power is on and left unattended for extended periods of time, vehicle battery power may be diminished.

Manual Display Controls/Indicator

A - Power On Indicator
B - Sensor #1 Alarm Indicators
C - Sensor #2 Alarm Indicators
D - Sensor Fault Indicators
E - Relay Delay / Reset Button
F - Relay On/Off Indicator
G - System Test Button
H - Audible Alarm Silence Button
I - Alarm Silenced Indicator
Indicator Definitions

Power Green = System Is On
Sensor Alarms:
  Trace = Small Gas Concentration Detected
  Significant = Dangerous Gas Concentration Detected
  Suspend Vehicle Operation Immediately
Sensor Fault Indicators:
  Off = Unit Functional
  On = Sensor or Wiring Fault Detected. Service System
Relay Reset Button = Resets Relay After Gas Alarm Has Cleared
Relay Indicator = Indicates Relay Is Engaged
  On = Relay Is Engaged
  Off = Relay Is In Normal Position - Not Engaged
Test Button = Tests LED’s and Electrical Circuits
Alarm Silence Button = Push To Silence Audible Alarm
Alarm Silenced Indicator = On Indicates Audible Alarm Has Been Silenced

Module Display Installation

The AMGaDS III display panel should be mounted in a convenient location on the instrument panel where the visual indicators may readily be seen. If the relay is configured for engine shutdown, the panel must be located within reach of a seated driver. Mount the display panel in a dry location out of the weather. There is no need to open the display panel as all wiring connections are made via external pluggable connectors. Using the template below as a guide, drill three 1 inch diameter holes for wiring connections and four 3/16 diameter holes for mounting screws as shown at desired location for display panel.

![Module Display Installation Diagram]

WARNING: DO NOT ATTEMPT TO REMOVE THE DISPLAY PANEL COVER. DOING SO WILL VOID ALL WARRANTIES.
Attach the keyed locking wiring connectors to their mating receptacles on the back of the display panel, feed the lead wires through the one inch holes and attach the display panel to the vehicle using appropriate bolts or self tapping screws.

**Sensor Installation**

The sensors supplied with the AMGaDS III connect to the display panel via cables with pluggable wiring connectors. Do not shorten or attempt to splice this cable. Doing so will affect the sensitivity of the unit. Cables are available in lengths of 10, 20, 35, 50, 65, 85 and 100 feet. (See list of replacement parts at the end of this manual).

Coil excessive cable in a convenient location and secure to the vehicle. Attach the sensors to the vehicle using the padded clamps provided for that purpose. Connect the sensors to the sensor cable from the display panel.

**CAUTION:** Do not attempt to use any other manufacturer’s sensor or previously installed sensors. It is necessary to use only genuine Amerex AMGaDS III sensors, which are designed specifically for this unit, from your Amerex dealer. Replacement sensors are available as Amerex P/N 14198.

**Sensor Location**

**CAUTION:** For proper system function it is critical to know whether the fuel vapors the AMGaDS III system will be detecting are lighter or heavier than air.

Mount the sensors where they will be as dry as possible. Water, mud, grease etc. can mask gas fumes from the sensor element. Do not mount in the direct path of road spray or oil spray.

DO NOT locate the methane sensor in an area where heat will exceed 212°F.

Propane is heavier than air and will settle. Therefore, it is important that sensor locations be selected that are as low as practical and below potential leak points such as valves and fittings when detecting propane.

CNG (Compressed Natural Gas), LNG (Liquid Natural Gas), Methanol & Hydrogen are lighter than air and will rise. Therefore, it is important that a location be selected that is above potential leak points. Ideally, the sensors should be located in cavities as high as possible where rising gas will be trapped.

Should you wish to detect vapors not listed above please contact Amerex Engineering to determine if AMGaDS III is suitable for your application.

**Auxiliary Relay Wiring**

The display panel of the AMGaDS III Plus contains an auxiliary single pole double throw (SPDT) relay that transfers 15 seconds after a Significant level gas concentration is detected. Typically this relay is used to shut off fuel supply or activate an auxiliary alarm. The relay is rated for 5 amps at 30 VDC. DO NOT exceed the maximum rating for this output.
Wiring The AMGaDS III (See Wiring Diagram Figure 5)

Sensor Connection

See wiring diagram. Plug sensor connection cables onto the sensors using the locking four pin connectors. Plug the other end of the sensor connection cable into the mating terminal on the display panel connectors. Make certain the terminals align properly and lock. Provide proper strain relief after connection to insure undue stress is not placed on the connectors. No calibration is required. 

Power Connection

See wiring diagram. Remove the fuse from the in line fuse holder on the red power lead. Note: the power lead also shares a pluggable five pin connector at the display panel with the relay connection lead. Connect the red wire that has the in line fuse holder to a suitable power source or connect directly to the battery positive (+) terminal if full time operation is required. Connect the black wire from the power lead to a suitable ground or to the negative (-) battery terminal. Input power to AMGaDS III must be 9 to 30 volts DC. Do not attempt to connect system to AC current. Plug the five pin connector into its matching receptacle at the display panel, and insure the connector is locked. Replace the 10 amp fuse back in the in line fuse holder. Use only a 10 amp type AGC fast blow fuse in the AMGaDS III System.

Operation

When first turned on, AMGaDS III goes through a self test cycle of all electrical and sensor functions. During the self test the sensor fault lights will remain on for a few seconds, and the Trace level LED may blink until the sensors have warmed up and become fully functional. Warm-up time will vary depending upon usage of the unit. Long periods of inactivity will require longer warm-up periods. When the self diagnostic test is complete and the sensors have warmed up and are on line, only the green “Power” LED will be illuminated. The test cycle may be repeated at any time by pressing and holding the “Push To Test Button” which is behind the Amerex logo. Pressing this button will also activate the internal relay. The system returns to normal when the test button is released.
Alarm Indications

Should either of the sensors detect gas fumes, the corresponding indicator for Zone 1 or Zone 2 will pulse an amber LED indicating a “Trace” level gas alarm. There is no audible alarm at trace. Trace alarm indicates the system has detected a gas concentration above 20% of the Lower Explosive Limit (LEL). Should either sensor detect gas fumes in concentrations above 50% LEL the red “SIGNIFICANT” LED will illuminate and the audible horn will sound. Also at SIGNIFICANT alarm, the relay control will transfer. Both the Trace and SIGNIFICANT alarm indicators will remain on as long as fumes are detected. **DO NOT** consider the area clear until the alarm indicators are off and the power light returns to green.

Only after the gas has cleared and the alarms are off may the internal relay be reset by pushing the “Relay Reset” button on the AMGaDS III Plus display panel.

Testing Display Mode

Internal operation of the display mode and relay may be tested using the “Push To Test” button behind the Amerex logo. Pressing the test button will simulate the above alarm conditions.

Sensor Fault Detection

Should the unit determine that either of the sensors is in fault condition or has been disconnected, the corresponding fault indicator LED, will illuminate. Check that the sensor is connected and that wiring has not been frayed or cut. Should this condition persist, the sensor has been damaged and **must** be replaced. Under normal operating conditions, the sensors will give years of service. However, they will eventually wear out. Frequently exposing the sensors to high concentrations of gas will accelerate this deterioration. When the sensor fails, it normally fails to fault condition OR locks in alarm. If a fault condition continues after wiring integrity has been verified, the sensor must be replaced. Also, if the sensor fails to respond to a two second burst of unburned gas from a cigarette lighter, it should be replaced. Replacement sensors are available from your Amerex dealer as P/N 14198.

Nuisance Alarms

The sensor used for the AMGaDS III is sensitive to all hydrocarbon vapors. An alarm may be triggered by the use of other chemicals such as cleaners, paint, polish, lacquer gasoline, etc. The sensors will also detect hydrogen fumes from an overcharged battery. If no gas fumes are present, check for recent use of cleaners, fiberglass repairs, strong adhesives, etc.

**WARNING:**

The AMGADS III has been designed to give a SIGNIFICANT level alarm at 50% of the LEL (Lower Explosive Limit) of Propane/Natural Gas. Implement immediately the following procedures in the event of an alarm. Shut down engine. Manually shut off the source of Propane/CNG/LNG. Turn off all electrical circuits EXCEPT circuits which operate blowers and/or exhaust fans. Remove all personnel from the area. Ventilate the area, turn on exhaust fans and open windows, hatches, etc. Carefully check all fuel lines, tanks, and fittings to locate the leak. Have the problem repaired by qualified personnel before further operation of the vehicle.
Wiring Diagram
Maintenance

The AMGADS III requires very little maintenance. The Gas Sensors are very durable and should give several years of service, but eventually they will wear out and need replacing. Semi-annually examine the sensors for contamination or damage. The sensor may be cleaned with a soft brush under warm running water if needed. Shake off excessive water before reinstalling. Check that sensor wires are not frayed, pinched, or cut.

Test the operation of both sensors and display module semi-annually.
To test the display panel, push the test button. To test the sensor, expose it to a two-second stream of unburned butane from a butane cigarette lighter, and verify that the display panel indicates a SIGNIFICANT alarm. Do NOT expose sensors to liquids or chemicals unnecessarily. When cleaning the vehicle, seal off the sensor(s) with a plastic covering. Harsh chemicals and extremely high temperatures may damage the sensor. Keep sensor(s) sealed until compartment has been completely ventilated. Each sensor has been sealed with a gas permeable, water-resistant pad. This pad is located on the inside of the sensor housing. Do not puncture or damage the sensor seal or sensor life will be significantly shortened.

WARNING: Do not forget to remove sensor coverings after cleaning the vehicle or the AMGaDS III will not operate correctly.

Specifications

Voltage .........................................................+9 to 30 VDC Nominal
Input Current .............................................................10 amps max.
Required Fuse Size ..................10 amp type AGC Fast Blow ONLY
Current Draw .............................45 mA per sensor @ 12 VDC
.................................................................27 mA per sensor @ 30 VDC
.................................................................130 mA max. (relay engaged)
Alarm ........................................ Trace Level = 20% Lower Explosive Limit (LEL)
.................................................................Significant Level = 50% Lower Explosive Limit (LEL)
Horn .................................................................75 dB @ 10cm 3kHz frequency
Relay Contacts ..............................................................5 amp max.

Additional and Replacement Parts

Display Panel AMGaDS III .......................................................P/N 16528
Power & relay cable replacement .......................................P/N 16537
Sensor with Mounting Clamp ........................................P/N 14198
Sensor Mounting Clamp Only ........................................P/N 14199
10 foot sensor cable ..............................................P/N 14925
20 foot sensor cable ..............................................P/N 14376
35 foot sensor cable ..............................................P/N 14201
50 foot sensor cable ..............................................P/N 14203
65 foot sensor cable ..............................................P/N 14466
85 foot sensor cable ..............................................P/N 14714
100 foot sensor cable .............................................P/N 16021
Sensor block out plug ..............................................P/N 14555
(used only with single sensor systems)

All replacement parts are available from your Amerex dealer. If you have additional questions or concerns, contact the Amerex Vehicle Systems Customer Service Department at (205) 655-3271.
WARNING

The AMGADS III is a propane, CNG (Compressed Natural Gas), LNG (Liquid Natural Gas) detector only. This device is meant to serve as a supplemental warning only. It is NOT intended to replace standard safety practices which should be carried out around explosive gases (i.e. inspect all rooms and compartments, check all gas fittings and connections, smell for propane/CNG gas fumes, etc.). To function properly the AMGADS III must be powered at all times. Contact Amerex before installing in applications which may appear different than those outlined in this manual. This device is not intended for use in aircraft.

There are no user or field serviceable parts for the display panels. The AMGaDS III panel must be returned to the manufacturer for any repair or trouble shooting beyond what is recommended in this manual. Installation shall be done by qualified personnel authorized to do so by the authorities having jurisdiction for the particular application in which the product is being used. Electrical wiring shall be in accordance with applicable codes. Improper wiring, including all wire connections, may render the unit inoperable, damage components, or cause a fire, and will void all warranties.

Warranty:

All components are warranted for three years from date of purchase against defects in workmanship and material. During the warranty period, any defective part will be repaired or replaced (at Amerex option). This warranty is valid only if the system has been installed in accordance with the instructions in this manual. This warranty does not cover normal use and wear of any part, defects resulting from modification, alteration, misuse, exposure to corrosive conditions or extremely high temperature, improper installation or maintenance. All warranties, including, but not limited to, warranties of fitness for purpose and merchantability, are limited to the time period as stated above. In no event shall Amerex Corp. be liable for incidental or consequential damages.
July 6, 2009

File No.: 60.62.A8147.9-1-0393

Mr. Robert Langer
Amerex Corporation
P. O. Box 81
Trussville, AL 35173-0081

Dear Mr. Langer:

This letter constitutes an exemption from the provisions of California Code of Regulations, Title 13 (13 CCR), Section 935(b)(2), regarding the audible and visible warning threshold requirements applicable to methane gas detection for vehicles equipped with liquefied natural gas (LNG) fuel systems. This exemption is issued for the sole purpose of allowing a dual-stage warning strategy for methane gas detection systems.

Current requirements contained in 13 CCR, Section 935(b)(2) stipulate that at a minimum the methane gas detection system shall provide an audible and visible warning before the methane gas concentration reaches 25 percent of the Lower Flammability Limit (LFL). The California Highway Patrol (CHP) intends to adopt Society of Automotive Engineers (SAE) Recommended Practice (Standard) J2343, “LNG Medium and Heavy-Duty Powered Vehicles,” July 2008, and National Fire Protection Association (NFPA) 52, “Vehicular Fuel Systems Code,” 2010 edition by reference in an upcoming rule making package amending 13 CCR, Section 935. This amendment will specifically include in Section 935(b)(2) the option of allowing methane gas detection systems to meet (1) the audible and visual warning performance requirements for gas concentration contained in SAE Standard J2343, July 2008, Section 4.9, regardless of vehicle type, or (2) the audible and visual warning performance requirements for gas concentration contained in NFPA 52, 2010 edition, Section 11.12.2.3.

This exemption is subject to the following conditions:

1. A dual-stage warning strategy for methane gas detection systems shall have a first stage (visual) warning when methane gas concentration reaches 20 percent of the LFL and a second stage (audible and visible) warning when methane gas concentration reaches 50 percent of the LFL, or -
2. A dual-stage warning strategy for methane gas detection systems shall have a first stage (visual) warning when methane gas concentration reaches 20 percent to 30 percent of the LFL and a second stage (audible and visible) warning when methane gas concentration reaches 50 percent to 60 percent of the LFL.

3. Every motor vehicle equipped with an LNG fuel system shall be equipped with a methane gas detection system which shall warn of the presence of methane in the engine compartment, driver's compartment, and any passenger compartment.

4. Such warning shall be plainly audible and visible to the driver before entering the driver's compartment and while seated in the normal driving position.

5. The gas detection system shall function continuously at all times, whether or not the engine is operating, when the vehicle is operated or parked on public roadways or other areas open to the public.

6. At a minimum, the gas detection system shall be tested three times per calendar year at equal intervals. The testing procedure shall simulate the same gaseous fuel and operating environment in which the vehicle is used. Test results, validating the performance of the gas detection system within the parameters established by the component manufacturer(s), shall be maintained as a permanent part of the vehicle service history records.

7. Each driver shall receive detailed instruction on the proper operation of the dual-stage warning methane gas detection system.

8. Vehicles in which a dual-stage warning methane gas detection system is installed shall remain in compliance with all other provisions of the California Vehicle Code (CVC) and 13 CCR.

9. A reproduction of this exemption shall be carried in the vehicle to which it applies, and an additional copy shall be retained in the maintenance file of the vehicle. A copy of this exemption shall be presented for inspection to any authorized employee of the CHP upon request.

This exemption is granted pursuant to Section 2402.6 CVC and 13 CCR, Section 937. This exemption is nontransferable and may be rescinded for good cause at any time. A violation of any condition of this exemption shall be considered a violation of Section 2402.6 CVC, and may constitute good cause to rescind the exemption.
If you have any questions regarding this exemption, please contact Mr. Cris Morgan, Staff Engineer, Commercial Vehicle Section, at (916) 445-1865.

Sincerely,

[Signature]

S. LORWILL, Chief
Enforcement Services Division