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**APPENDIX: Test Record Sheets**

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| **Test Writer: Noah Harvey** | | | | | | | | | |
| **Test Case Name:** | | Gas Sensor System Functional Test #1 | | | | | **Test ID #:** | GAS-FUN-01 | |
| **Description:** | | Verify system reports unacceptable levels of gas detection. | | | | | **Type:** | Black Box | |
| **Tester Information** | | | | | | | | | |
| **Name of Tester:** | |  | | | | | **Date:** | |  |
| **Hardware Ver:** | | 1.0 | | | | | **Time:** | |  |
| **Setup:** | | Power on the gas sensor system. Allow gas sensor to preheat for 24 hours. Locate gas delivery system in proximity of gas detection sensor. | | | | | | | |
| **Step** | **Action** | **Expected Result** | **Pass** | **Fail** | **N/A** | **Comments** | | | |
| 1 | Deploy gas fumes near gas sensor | Gas sensor provides voltage < 0.1 V. |  |  |  | Sensor must be preheated and located in controlled environment. | | | |
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| **Test Writer: Noah Harvey** | | | | | | | | | |
| **Test Case Name:** | | Gas Sensor System Functional Test #2 | | | | | **Test ID #:** | GAS-FUN-02 | |
| **Description:** | | Verify system connects wirelessly to actuator system. | | | | | **Type:** | Black Box | |
| **Tester Information** | | | | | | | | | |
| **Name of Tester:** | |  | | | | | **Date:** | |  |
| **Hardware Ver:** | | 1.0 | | | | | **Time:** | |  |
| **Setup:** | | Power on gas sensor and actuator systems. Power on computer/laptop. Connect computer to both ESP8266 Wifi modules. | | | | | | | |
| **Step** | **Action** | **Expected Result** | **Pass** | **Fail** | **N/A** | **Comments** | | | |
| 1 | Download server and client code to the respective wifi modules. | Code is downloaded with no errors |  |  |  | Verified by Arduino IDE | | | |
| 2 | Connect wifi modules in point-to-point configuration. | Connection successful displayed |  |  |  | Verified by Arduino IDE | | | |
| **Overall test result:** | | |  |  |  |  | | | |

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| **Test Writer: Noah Harvey** | | | | | | | | | |
| **Test Case Name:** | | Gas Sensor System Functional Test #3 | | | | | **Test ID #:** | GAS-FUN-03 | |
| **Description:** | | Verify system alarmed state reset function. | | | | | **Type:** | Black Box | |
| **Tester Information** | | | | | | | | | |
| **Name of Tester:** | |  | | | | | **Date:** | |  |
| **Hardware Ver:** | | 1.0 | | | | | **Time:** | |  |
| **Setup:** | | Power on actuator system. Connect computer/laptop to actuator wifi module. Load alarm test program to actuator system. | | | | | | | |
| **Step** | **Action** | **Expected Result** | **Pass** | **Fail** | **N/A** | **Comments** | | | |
| 1 | Initiate alarmed state through Arduino IDE code. | Actuator closes gas valve |  |  |  | Initiated by computer/laptop. Verified by physical valve movement. | | | |
| 2 | Manually press user button to reset alarmed state | Actuator opens gas valve |  |  |  |  | | | |
| **Overall test result:** | | |  |  |  |  | | | |

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| **Test Writer: Noah Harvey** | | | | | | | | | | | | | | | |
| **Test Case Name:** | | | | Gas Sensor System Integration Test #1 | | | | | | | **Test ID #:** | GAS-INT-01 | | |
| **Description:** | | | | Verify the MQ5 gas sensor functionally operates within gas density specifications. | | | | | | | **Type:** | Black Box  White Box | | |
| **Tester Information** | | | | | | | | | | | | | | | |
| **Name of Tester:** | | | |  | | | | | | | **Date:** | |  | |
| **Hardware Ver:** | | | | 1.0 | | | | | | | **Time:** | |  | |
| **Setup:** | | | | Connect MQ5 gas sensor system to power supply. Set initial sensing resistance or load resistor to 20kOhm. Deploy gas in proximity of gas sensor. | | | | | | | | | | |
| **Step** | **Voltage (VC)** | **Load Resistance (RL / Ohms)** | **Gas Type** | **Expected Result** | **Pass** | **Fail** | | **N/A** | | **Comments** | | | |
| 1 | 5.0 V | 20k | None | 3.6 V Output |  |  | |  | | None deployed gas case | | | |
| 1 | 5.0 V | 20k | Natural | < 0.1 V Output |  |  | |  | | Gas sensor must be preheated for 24 hours before testing can be completed. | | | |
| 2 | 5.0 V | 10k | Natural | < 0.1 V Output |  |  | |  | |  | | | |
| 3 | 5.0 V | 60k | Natural | < 0.1 V Output |  |  | |  | |  | | | |
| **Overall test result:** | | | | |  |  |  | |  | | | | |

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| **Test Writer: Noah Harvey** | | | | | | | | | |
| **Test Case Name:** | | Gas Sensor System Integration Test #2 | | | | | **Test ID #:** | GAS-INT-02 | |
| **Description:** | | Verify ESP8266 Wifi Module operates and connects to actuator ESP8266 Wifi module | | | | | **Type:** | Black Box  White Box | |
| **Tester Information** | | | | | | | | | |
| **Name of Tester:** | |  | | | | | **Date:** | |  |
| **Hardware Ver:** | | 1.0 | | | | | **Time:** | |  |
| **Setup:** | | Power on gas sensor and actuator systems. Connect computer to ESP8266 modules on both the detector and actuator systems. Load IDE Wifi verification program to both detector and actuator systems. | | | | | | | |
| **Step** | **Action** | **Expected Result** | **Pass** | **Fail** | **N/A** | **Comments** | | | |
| 1 | Connect to gas sensor wifi module. | Connection Successful. |  |  |  | Verified by Arduino IDE. | | | |
| 2 | Connect to actuator system | Connection Successful. |  |  |  | Verified by Arduino IDE. | | | |
| 3 | Send data packets to actuator system | Actuator system received data packets with zero data loss. |  |  |  | Auxiliary LED should light. | | | |
| 4 | Send command data packets to actuator system | Actuator closes gas valve. |  |  |  |  | | | |
| 5 | Send data packets to detector system | Detector system received data packets with zero data loss. |  |  |  | Commands sent from actuator wifi module to gas sensor wifi module. | | | |
| **Overall test result:** | | |  |  |  |  | | | |

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| **Test Writer: Noah Harvey** | | | | | | | | | |
| **Test Case Name:** | | Gas Sensor System Integration Test #3 | | | | | **Test ID #:** | GAS-INT-03 | |
| **Description:** | | Verify actuator system responds to commands and closes gas valve. | | | | | **Type:** | Black Box  White Box | |
| **Tester Information** | | | | | | | | | |
| **Name of Tester:** | |  | | | | | **Date:** | |  |
| **Hardware Ver:** | | 1.0 | | | | | **Time:** | |  |
| **Setup:** | | Power on computer/laptop and connect to both ESP8266 Wifi modules. Load IDE actuator test code to both ESP8266 modules. | | | | | | | |
| **Step** | **Action** | **Expected Result** | **Pass** | **Fail** | **N/A** | **Comments** | | | |
| 1 | Send gas detection commands to actuator system. | Actuator system closes gas valve. |  |  |  |  | | | |
| 2 | Valve closed detection | Gas valve closed verified by return signal response. |  |  |  |  | | | |
| 3 | Press reset user button | Actuator opens gas valve. |  |  |  |  | | | |
| 4 | Valve opened detection | Gas valve opened verified by return signal response. |  |  |  |  | | | |
| **Overall test result:** | | |  |  |  |  | | | |

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| **Test Writer: Noah Harvey** | | | | | | | | | | | | | | | |
| **Test Case Name:** | | | | Gas Sensor System Temperature Test #1 | | | | | | | **Test ID #:** | GAS-TEM-01 | | |
| **Description:** | | | | Verify the gas sensor system functionally operates within a relatively acceptable temperature range. | | | | | | | **Type:** | Black Box  White Box | | |
| **Tester Information** | | | | | | | | | | | | | | | |
| **Name of Tester:** | | | |  | | | | | | | **Date:** | |  | |
| **Hardware Ver:** | | | | 1.0 | | | | | | | **Time:** | |  | |
| **Setup:** | | | | Power on computer/laptop and connect to ESP8266 wifi modules on both detection and actuator systems. Power on both systems. Load IDE normal operating program to both ESP8266 modules. Adjust environment temperature to meeting specifications. Deploy gas in proximity of gas sensor. | | | | | | | | | | |
| **Step** | **Temp. (oC)** | **Load Resistance (RL / Ohms)** | **Gas Type** | **Expected Result** | **Pass** | **Fail** | | **N/A** | | **Comments** | | | |
| 1 | 20 | 20k | Natural | Actuator both closes and opens gas valve. |  |  | |  | | Gas sensor must be preheated for 24 hours before testing can be completed. | | | |
| 2 | -10 | 20k | Natural | Actuator both closes and opens gas valve. |  |  | |  | |  | | | |
| 3 | 60 | 20k | Natural | Actuator both closes and opens gas valve. |  |  | |  | |  | | | |
| **Overall test result:** | | | | |  |  |  | |  | | | | |