Installation Guide

General Information

SAE-1062
(Duct)

SAE-1012
(Space)

⚠ WARNING

Do not use in an explosive or hazardous environment, with combustible or flammable gases, as a safety or emergency stop device, or in any other application where failure of the product could result in personal injury.

⚠ CAUTION

Read these instructions carefully before installing and commissioning the CO_2 detector. Failure to do so may result in product damage.

Strong shock or vibration may affect the calibration of the SAE-1011/1012/1062. Be careful to not drop the detector while installing or calibrating it. Take electrostatic discharge precautions during installation. Do not exceed the device ratings.

NOTE: **The SAE-1011/1012/1062 models replace the older SAE-1001/1002/1051 models.** For the installation and configuration information on the older models, see the SAE-1001/1002/1051 installation guide (717-019-37).

NOTE: The IEI-1011 LCD display module (used with the SAE-1001/1051 models for configuration) does **not** apply to the SAE-1011/1012/1062 models since they each have permanent LCD displays. The display of the SAE-1011, however, is hidden when its cover is closed.

NOTE: See the SAE-1011/1012/1062 data sheet for specifications and additional information.

Mounting

SAE-1011/1012 Space Mount

Install the unit at least five feet above the floor of the area to be controlled. Do not install near doors, windows, supply air diffusers, or other known air disturbances. Avoid areas where the detector is exposed to vibrations or rapid temperature changes.

1. Remove the Phillips-head screw on the bottom edge of the cover. (See Illustration 1.)
2. The cover is hooked to the base/backplate at the top edge and must be removed from the bottom edge first. Tip the cover away from the base and set it aside. (If necessary, use a small screwdriver to carefully pry each bottom corner.)

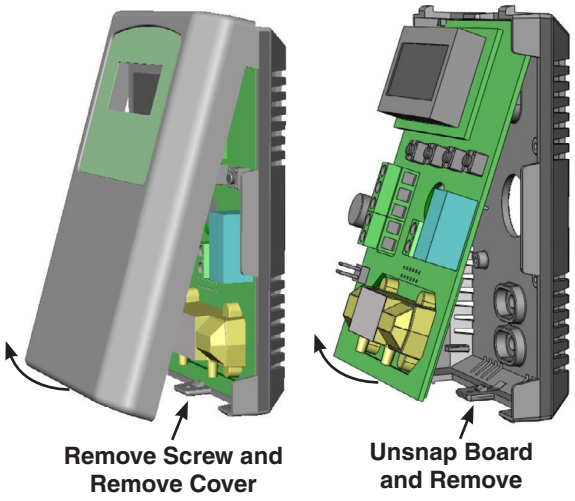

Illustration 1—SAE-1011/1012 Cover and Board Removal

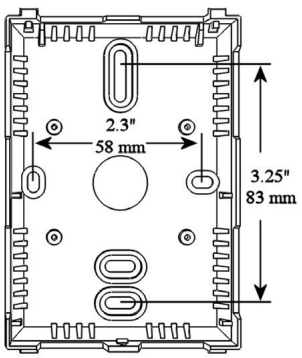

Illustration 2—SAE-1011/1012 Backplate

3. To access the mounting holes, **CAREFULLY** remove the circuit board from the base by gently pressing the enclosure base to unsnap the latch near the bottom edge and lifting the circuit board from the backplate.

⚠ CAUTION

Follow proper electrostatic discharge procedures when handling the circuit board and be careful to not touch the sensors.

4. Set the circuit board aside until the base is mounted on the wall.
5. Attach the universal backplate/base directly to a standard electrical box using two screws. (See Illustration 2.)
6. After the base is secured, pull the wires through the wiring hole in the center of the circuit board and then reinstall the board in the enclosure base. Ensure the circuit board is snapped into the base securely and correctly.
7. After wiring, configuring, and testing the unit, reinstall the cover and screw.

SAE-1062 Duct Mount

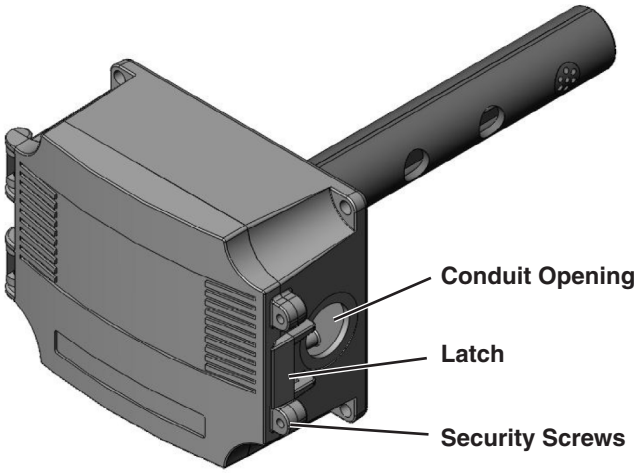

Illustration 3—SAE-1062 Enclosure

The duct type sensor installs on the outside of a **return** air duct with the sampling tube inserted into the duct.

Choose a mounting location in a straight section of a return air duct. Mount at least 5 feet (or 7.5 duct diameters) from corners or other items that may cause disturbances in the air flow. Avoid areas prone to vibration or rapid temperature changes.

1. Cut a 1-1/4" hole in the duct for the air sampling tube.
2. Insert the probe into the hole and mark the enclosure mounting holes. (See Illustration 4.)
3. Remove the unit and drill the four mounting holes. (Clean all drilled holes of debris before mounting the device.)
4. Mount the enclosure to the duct with four sheet metal screws such that the duct air flow is parallel with the vent holes in the probe (i.e., air flows directly into the probe holes). To prevent air leaks, ensure the gasket is compressed around the probe between the device enclosure and the air duct.
5. Open the cover by removing the two screws and releasing the latch. (See Illustration 3.)
6. Attach conduit to the conduit opening.
7. Feed wires through the conduit opening, and connect to the terminals according to the wiring instructions.
8. After wiring, plug the conduit with plumber's putty, painter's putty, caulk, or other sealant to prevent air infiltration from affecting accuracy of the duct readings.
9. Check that the rubber gasket is placed correctly between the enclosure and cover.
10. After wiring, configuring, and testing the unit, close and latch the cover. Secure it with the two screws.

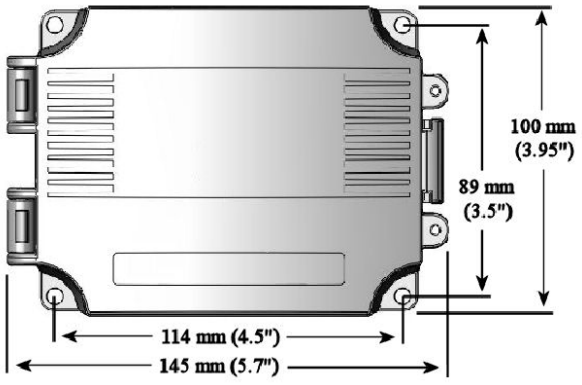

Illustration 4—SAE-1062 Mounting Dimensions

Wiring

Use 22 AWG shielded wiring for connections. Do not locate device wires in the same conduit with wiring used to supply inductive loads.

1. Connect the **positive** DC voltage, or the **hot/phase** side of the AC voltage, to the terminal marked **POWER** (but **do not apply power until all wiring is completed**). (See Illustrations 5 and 6.)
2. Connect the power supply common to the terminal marked **COM**. The device is reverse voltage protected and will not operate if connected backwards.

NOTE: The detectors have a half-wave power supply with the common the same as the output signal common. If several units are connected to one power supply, output signals share the same signal common. However, KMC recommends using a separate transformer for each device.

⚠ CAUTION

Use caution when grounding the secondary of an AC transformer, or when wiring multiple devices, to ensure that the circuit ground point is the same on all devices and the controller. See Application Note AN0604D "Tips for connecting 24-volt power" available from the KMC Controls web site or in the SP-022 Digital Designer Guide.

3. On the Output switch, select the desired analog signal output as either current (4–20 mA) or voltage (0–5 VDC is the default, but 0–10 VDC is selectable through the menu). Using the defaults, 4–20 mA or 0–5 VDC correspond linearly to 0–2000 ppm of CO_2.

⚠ CAUTION

The 4-20 mA current output signal operates in the active mode and does not require a loop power supply. The signal current is generated by the SAE-1000 series detector and must not be connected to a powered input or device damage will result.

4. Set the input jumpers/pull-up resistors on the connected controller for the desired active voltage or current according to the controller's instructions and connect the detector's output to the controller's input.
5. The SAE-1012 (only) has a form "A" Normally Open (NO) SPST relay. The relay output is completely isolated from other circuitry. Wire it to the desired circuit.

NOTE: Do NOT remove the rubber caps from the calibration ports on the sensor except during calibration.

NOTE: See also Application Note AN0504L "Connecting inputs and outputs to KMC controllers" available from the KMC Controls web site or in the SP-022 Digital Designer Guide.

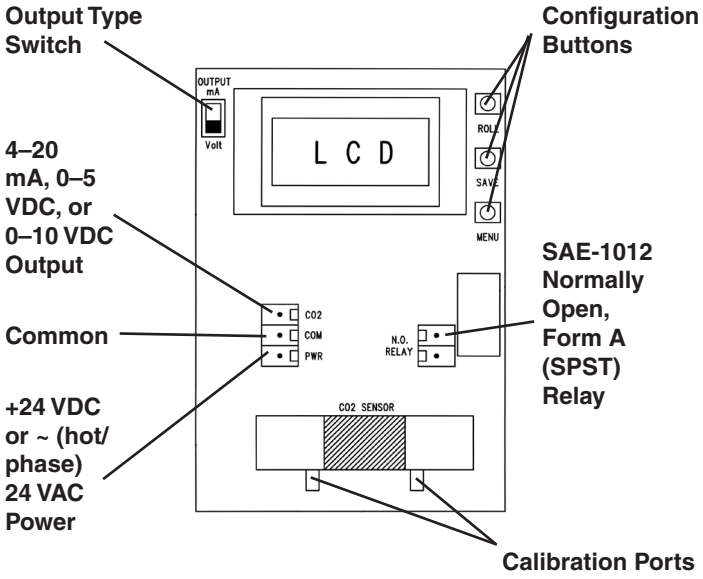

Illustration 5—SAE-1011/1012 Space Sensor Board

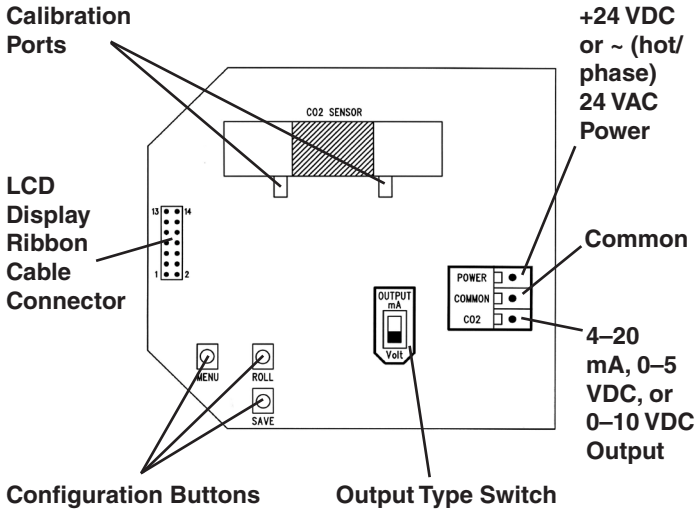

Illustration 6—SAE-1062 Duct Sensor Board

Set-Up

Warm-Up

1. Verify that the detector is properly wired, all connections are tight, and the Output switch is in the correct mA or Volt position.
2. Apply power.

The CO_2 sensor chamber light will flash on and off. The LCD display will indicate the software version number, the output signal type, the relay setpoint (SAE-1012 only), and the CO_2 measurement range. **During the warm-up (of less than two minutes), the output is fixed at representing 500 ppm.** After the warm-up period the sensor will begin reading the CO_2 level, output the correct analog signal, and display the value on the LCD.

During normal operation, the sensor updates the output and display every 4 seconds.

Menu Configuration

The menu is controlled by pressing buttons on the circuit board:

- **Press and release the MENU button to enter the configuration menu. Then press the MENU button to step through the selections.**
- **Use the ROLL buttons to make changes.**
- No values are saved or changed until you press the SAVE key. **The SAVE button saves the current setting to memory and advances to the next Menu item.**

While in normal operation, to enter the configuration menu, press the MENU button:

1. **OUT_HIGH 2000 PPM:** (Default CO_2 level range is 0–**2000** ppm.) The span can be changed from 1,000 to 7,500 ppm measured in 500 ppm increments. For maximum accuracy in typical applications, a narrower (e.g., the default) range is recommended.
   Press the MENU button.
2. **ALTITUDE 0FT:** (Default altitude is 0 feet.) The range is 0 to 5,000 feet measured in 500-foot increments. Change for local altitude correction for maximum accuracy. (Altitude/elevation for any particular location can be found at such sources as ***www.earthtools.org***.)
   Press the MENU button.
3. **AUTO_CAL ON:** (Default is ON.) This corrects sensor drift to better than ± 10 ppm per year. ON is recommended for locations where CO_2 levels will be close to 400 ppm at least once a day. If a building is continuously occupied for 24 hours, and the CO_2 level is fairly constant, then this should be set to OFF. **(See the Calibration section!)**
   Press the MENU button.
4. **RELAY SP 1000 PPM:** (Relay trip setpoint default is 1,000 ppm.) The range is 500 to 5,000 ppm measured in 100 ppm increments. (For SAE-1012 only.)
   Press the MENU button.
5. **RELAY HY 50 PPM:** (Relay hysteresis "deadband" default is 50 ppm.) The range is 25 to 200 ppm measured in 25 ppm increments.
   Press the MENU button.
6. **RELAY TEST OFF:** (Relay status default is OFF.) For testing purposes, use the ROLL button to toggle the relay ON or OFF.
   Press the MENU button.
7. **OUT TYPE 0-5 VDC:** (Voltage output default is 0–5 VDC.) Use the ROLL button to toggle 0–5 VDC or 0–10 VDC. If the switch is set to mA, then 4-20 mA is displayed.
   Press the MENU button.
8. **OUTPUT TEST OFF:** (Default is OFF.) For testing purposes, use the ROLL button to toggle the output OFF (for normal operation), MIN (minimum output), or MAX (maximum output).
   Press the MENU button.
9. **CALIBRAT 1000 PPM:** Used in calibration. **See the Calibration section.**
   Press the MENU button.
10. **BACKLIGHT ENABLE:** (Default is ENABLED.) When enabled, the backlight is always on; when disabled, it never illuminates.
    Press the MENU button.
11. **RESTORE DEFAULTS:** Press the SAVE key to restore all the original factory settings.
    Press the MENU button.
12. **MENU EXIT:** Press the SAVE button to exit the menu and return to normal operation or MENU to repeat the menu.

Calibration

CO_2 Self-Calibration

NOTE: After power is first applied, the sensor goes through a warm-up. Until warm-up is complete, the sensor count will display 500 ppm.

These self-calibrating detectors use the sensor's on-board microprocessor to remember the lowest CO_2 concentration measured in a 24 hour period. The sensor assumes this low point is at outside levels. (The smart sensor discounts periodic elevated readings that might occur if, for example, a space was used 24 hours per day over a few days.)

After collecting 14 days worth of low concentration points, the sensor performs a statistical analysis comparing sensor readings to background levels. If there have been any small changes that could be attributable to sensor drift, a small correction factor is made to the sensor calibration to adjust for this change. Autocalibration corrects sensor drift to better than ±10 ppm per year.

If a space does not experience a periodic drop to outside levels (e.g., where occupancy is 24 hours, 7 days/week), the self-calibration software should be deactivated. If the software has been deactivated (via menu buttons), calibration may be required every two to three years.

NOTE: To comply with **CA Title 24, Section 121(c), as well as sub-paragraph 4.F** that specifies accuracy will be maintained within tolerance for a minimum of 5 years without recalibration, **autocalibration must be ON and the sensor must be in a zone that experiences periodic drops to outside levels.**

CO_2 Calibration with Gas

Calibration with gas requires a bottle of 1000 ppm CO_2 gas, a tank pressure regulator with flow restrictor, and the necessary tubing to connect to the device (obtained locally or from vendors such as instrumart.com, testequipmentdepot.com, grainger.com, calibration-gas.com, and/or buycalgas.com).

NOTE: Because of the Automatic Calibration Mode and other technology incorporated into these detectors, only a single point 1000 ppm calibration is required to meet specified accuracy.

NOTE: The detector must be operating normally for at least five minutes before applying gas to it.

1. Turn the regulator On/Off knob fully Off, attach it to the 1000 ppm CO_2 gas bottle, and firmly tighten it by hand.

⚠ CAUTION

Strong shock or vibration can affect calibration.

2. Remove the cover of the SAE-1011/1012/1062 to expose the gas sensor chamber, gently remove the cap from (only) **one** port on the chamber, and connect the tubing from the regulator to that port. (The tubing can be connected to either port.)
3. Ensure the device has been operating normally for at least five minutes before applying gas, and slowly turn the valve knob on the regulator to let the gas begin flowing.
4. The regulator will restrict the flow rate to the specified 100 ml/min. After a brief period the gas will flow into the chamber and the CO_2 reading on the LCD will begin to approach 1000 ppm. Wait 1 to 2 minutes until the CO_2 reading stabilizes.
5. Enter the Setup menu and use the MENU key to advance to Calibrat 1000 PPM. Press and hold the SAVE key for 2 seconds and the display will change to **Waiting Calibrat** then to **Waiting 5 minute** to indicate that the process of reprogramming the internal calibration setting is taking place.
6. This calibration process takes about 5 minutes and the LCD will count down the minutes. Do not disturb the unit or the gas flow during this period. When calibration is complete the unit will display **Calibrat Done**. Press the SAVE key to return to normal operation
7. Shut off the gas, disconnect the tubing, replace the cap on the sensor chamber, and close the cover.

Signal Output Calibration

Testing and calibration of output voltage/current is available through the set-up and output test menus. See the Set-Up section.

Maintenance

Careful installation will also ensure long-term reliability and performance. Remove dust as necessary from holes. Clean with a soft, damp cloth and mild soap.

Troubleshooting Tips

- During setup of an SAE-1012, if **menu items concerning the relay disappear** after a change has been saved, cycle the power to the device.
- If **signal output and/or ppm reading is not what is expected initially**, the output is fixed at representing 500 ppm during warm-up. (It was 0 ppm in the older SAE-1001/1002/1051s.) After the warm-up period the sensor will begin reading the CO_2 level, output the correct analog signal, and display the value on the LCD.

Accessories

XEE-6111-040	Transformer, 120-to-24 VAC, 40 VA, **single**-hub
XEE-6112-040	Transformer, 120-to-24 VAC, 40 VA, **dual**-hub

Models

SAE-1011*	Space CO_2 sensor, with hidden LCD display (replaces older SAE-1001)
SAE-1012**	Space CO_2 sensor, with SPST relay (replaces older SAE-1002)
SAE-1062	Duct CO_2 sensor (replaces older SAE-1051)

*NOTE: All models have an LCD display, but the one inside the SAE-1011 is hidden from view when the cover is closed.

**NOTE: Only the SAE-1012 has a relay.

Important Notices

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Specifications

Power Supply 20–28 VAC/VDC (non-isolated half-wave rectified)

Consumption 100 mA max. @ 24 VDC, 185 mA max. @ 24 VAC (with all options)

Wiring Connections Screw terminal block (14–22 AWG)

Output Signal 4–20 mA active (sourcing), 0–5 VDC, or 0–10 VDC

Output Drive Capability 550 ohm max. for current output, 10K ohm min. for voltage output

Relay Output (SAE-1012 only)

Configuration: One form "A" contact (NO SPST), 2 A @ 140 VAC, 2 A @ 30 VDC, power factor = 1

Trip Point: 500 to 5,000 ppm, configurable in 100 ppm increments

Hysteresis/Deadband: 25 to 200 ppm, configurable in 25 ppm increments

Monitor Range 0–2000 ppm (factory default) configurable from 0–7500 (in 500 ppm increments)

Standard Accuracy ±75 ppm @ 1000 ppm @ 72° F (22° C) when compared to certified calibration gas

Altitude Correction Configurable from 0–5000 ft.

Response Time < 2 minutes for 90% step change

Warm-up Time < 2 minutes

Coverage Area 1000 sq. ft (100 sq. m) typical

Operation Conditions 32–122° F (0–50° C), 0–95% RH non-condensing

NOTE: For additional specifications, see the SAE-1011/1012/1062 data sheet.

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