ENGINEERING TOMORROW

Installation and Operation Guide

# Danfoss Gas Sensor
## Type DGS-SC and DGS-IR with MODBUS

ADAP-KOOL® Refrigeration Control System

## Contents

# 1. Overview

## 1.1 General Information

The DGS Modbus is a state-of-the-art fixed gas detector which can detect a wide range of gases. It can also activate external systems such as fans or shut down and activate sirens, warning lights, activate dial out systems, or connect to BMS systems including Danfoss AK-SM 720/ AK-SM 350 and the AK-SM 800 series.

The DGS Modbus can be used:
• in new buildings/areas that require continuous monitoring.
• to add gas detection solutions to an existing system.

## 1.2 Technical Specifications

<table>
<tr><td>Power Supply</td><td colspan="3">12/24V AC/DC ±20%, 50/60 Hz, 2 W max.</td></tr>
<tr><td>Power Consump-tion</td><td colspan="3">SC:153mA / IR: 136mA</td></tr>
<tr><td>Power Monitoring</td><td colspan="3">Green LED indication</td></tr>
<tr><td>Visual Alarm</td><td colspan="3">RED LED indication</td></tr>
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<tr><td>Fault Monitoring</td><td colspan="3">Red LED ON ~ Green LED OFF</td></tr>
<tr><td>Fault State</td><td colspan="3">0 - 0.5V (1-5V), 0 - 1V(2-10V), 0 - 2mA (4-20mA)</td></tr>
<tr><td>Analogue Outputs</td><td colspan="3">0-5V, 1-5V, 0-10V, 2-10V, 4-20mA</td></tr>
<tr><td>Digital Outputs</td><td colspan="3">1-Relay, SPDT, Failsafe configured by Modbus or by product selection<br>1-Amp / 24V A.C./D.C. / 120V A.C.<br>Configurable delay by Modbus or by jumper configuration: 0, 1min., 5min., 10min.</td></tr>
<tr><td>IP Enclosure rating</td><td colspan="3">IP 41 or IP 66</td></tr>
<tr><td rowspan="2">Temperature Rat-ings</td><td colspan="3">IP 41: -20°C to +50°C ( -4°F to 122°F )</td></tr>
<tr><td colspan="3">IP 66: -40°C to +50°C (-40°F to +122°F )</td></tr>
<tr><td rowspan="4">Dimensions/ Weights per Enclo-sure Type</td><td>IP41</td><td>86 x 142 x 53 mm<br>3.35" x 5.59" x 2.09"</td><td>180 g<br>6.3 oz</td></tr>
<tr><td>IP66</td><td>175 x 165 x 82 mm<br>6.89" x 6.5" x 3.29"</td><td>629 g<br>1 lb 6 oz</td></tr>
<tr><td>IP66 w/ Remote Sensor</td><td>175 x 155 x 82 mm<br>6.89" x 6.1" x 3.29"</td><td>790 g<br>1 lb 11 oz</td></tr>
<tr><td>IP66 Airflow/ Duct *</td><td>175 x 125 x 82 mm<br>6.89" x 4.9" x 3.29"</td><td>578 g<br>1 lb 4 oz</td></tr>
<tr><td>RS-485 Communi-cations</td><td colspan="3">Baud rate : 9,600, 19,200 or 38,400 (default)<br>Start bits: 1 Data bits: 8<br>Parity: even Stop bits: 1<br>Retry time: 500ms (min time between retries)<br>End of message: silent 3.5 characters</td></tr>
<tr><td>Approvals</td><td colspan="3">CE IEC61010-1 RoHS WEEE</td></tr>
</table>

* See appendix A for supported air flows and duct sizes

# 2. General Placement Guidelines

**NOTE**: The DGS Modbus should be installed plumb and level and securely fastened to a rigid mounting surface.

Sensors must be located within the appropriate wire lengths from the central control unit (if used).
In all cases the sensor supplied is designed for maximum sensitivity to a particular gas. However, in certain circumstances false alarms may be caused by the occasional presence of sufficiently high concentrations of other gaseous impurities. Examples of situations where such abnormalities may arise include the following:
- Plant room maintenance activity involving solvent or paint fumes or refrigerant leaks.
- Accidental gas migration in fruit ripening/storage facilities (bananas - ethylene, apples - carbon dioxide).
- Heavy localised exhaust fumes (carbon monoxide, dioxide, propane) from engine-driven forklifts in confined spaces or close to sensors.

It is recommended setting the alarm delay to minimise false alarms.

## 2.1 Machinery Rooms

There is no absolute rule in determining the number of sensors and their locations. However, a number of simple guidelines will help to make a decision. Sensors monitor a point as opposed to an area. If the gas leak does not reach the sensor then no alarm will be triggered. Therefore, it is extremely important to carefully select the sensor location. Also consider ease of access for maintenance.
The size and nature of the site will help to decide which method is the most appropriate to use. Locations requiring the most protection in a machinery or plant room would be around compressors, pressurised storage vessels, refrigerant cylinders or storage rooms or pipelines. The most common leak sources are valves, gauges, flanges, joints (brazed or mechanical), filling or draining connections, etc.
- When mechanical or natural ventilation is present, mount a sensor in the airflow.
- In machinery rooms where there is no discernible or strong airflow then options are:

Point Detection, where sensors are located as near as possible to the most likely sources of leakage, such as the compressor, expansion valves, mechanical joints or cable duct trenches.
Perimeter Detection, where sensors completely surround the area or equipment.

- For **heavier-than-air gases** such as halocarbon and hydrocarbon refrigerants such as R404A, propane, and butane sensors should be located near ground level.
- For **lighter-than-air gas** (e.g., ammonia), the sensor needs to be located above the equipment to be monitored on a bracket or high on a wall within 300 mm (12 in) of (or on) the ceiling – provided there is no possibility of a thermal layer trapped under the ceiling preventing gas from reaching the sensor.

NOTE: At very low temperatures (e.g., refrigerated cold store), ammonia gas becomes heavier than air.

- With similar density or miscible gases (e.g., CO2), sensors should be mounted about head high (about 1.5 m [5 ft]).
  However, with $CO_2$ in a machinery room it is recommended to mount it 0.3 m (1 ft) above the floor as the air flow is low and $CO_2$ slightly heavier than air.
- Sensors should be positioned just far enough back from any high-pressure parts to allow gas clouds to form and be detected. Otherwise, a gas leak might pass by in a high-speed jet and not be detected by the sensor.
- Make sure that pits, stairwells and trenches are monitored since they may fill with stagnant pockets of gas.
- For racks or chillers pre-fitted with refrigerant sensors, these should be mounted so as to monitor the compressors. If extract ducts are fitted the airflow in the duct may be monitored.

## 2.2 Refrigerated Spaces

In refrigerated spaces, sensors should be located in the return airflow to the evaporators on a sidewall (below head-high is preferred), or on the ceiling, not directly in front of an evaporator. In large rooms with multiple evaporators, sensors should be mounted on the central line between 2 adjacent evaporators, as turbulence will result in airflows mixing.

## 2.3 Chillers

In the case of small water- or air-cooled enclosed chiller units mount the sensor so as to monitor airflow to the extract fans. With larger models also place a sensor inside the enclosure under or adjacent to the compressors.
In the case of outdoor units:
- For enclosed air-cooled chillers or the outdoor unit for variable refrigerant volume and variable refrigerant flow (VRV/VRF) systems, mount the sensor so as to monitor airflow to the extract fan. With large units also place a sensor inside the enclosure under or adjacent to the compressors.
  In the case of non-enclosed outdoor units:
- If there is an enclosed machinery section locate a sensor there.
- In the case of units with enclosed compressors, mount sensors in the enclosures.
- Where you have protective or acoustic panels mount the sensor low down under the compressors where it is protected by the panels.
- With air-cooled chillers or air-cooled condensers with non-enclosed condenser sections it is difficult to effectively monitor leaks in the coil sections. With some designs it will be possible using an airflow sensor to monitor airflow to the start–up fans in the front or rear sections.
- If there is a possibility of refrigerant leaks into a duct or air-handling unit install a sensor to monitor the airflow.
  Weatherproof sensors should be used for unprotected outdoor applications.

## 2.4 Air Conditioning (Direct Systems VRF/VRV)

For compliance with EN378, at least one detector shall be installed in each occupied space being considered and the location of detectors shall be chosen in relation to the refrigerant and they shall be located where the refrigerant from the leak will collect. In this case refrigerants are heavier than air and detectors should have their sensors mounted low, e.g., at less than bed height in the case of an hotel or other similar Category Class A spaces. Ceilings or other voids if not sealed are part of the occupied space.

⚠

CAUTION: Monitoring ceiling voids in a hotel room would not strictly comply with EN378.

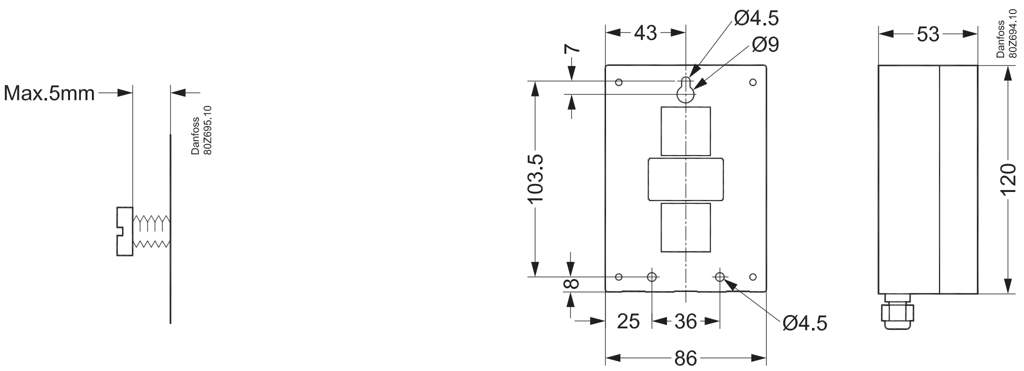
Best practice installation includes installing the gas detector at a height below the room occupants. E.g. in a hotel room this is less than bed height (between 200 and 500 mm [8 and 20 inches] off the floor).

Ensure the sensor is mounted away from drafts and heat sources like radiators etc. and avoid sources of steam.

Avoid mounting it under mirrors, at vanity units and in or near bed bathrooms.

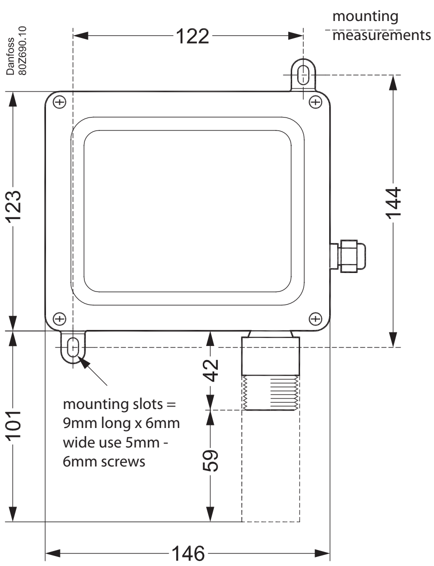
# 3. Dimensions and mounting

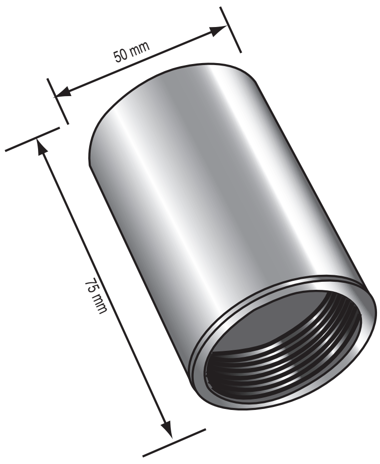
**DGS Modbus Standard Housing**




2

**IP66 (with Splashguard)**




Splashguard

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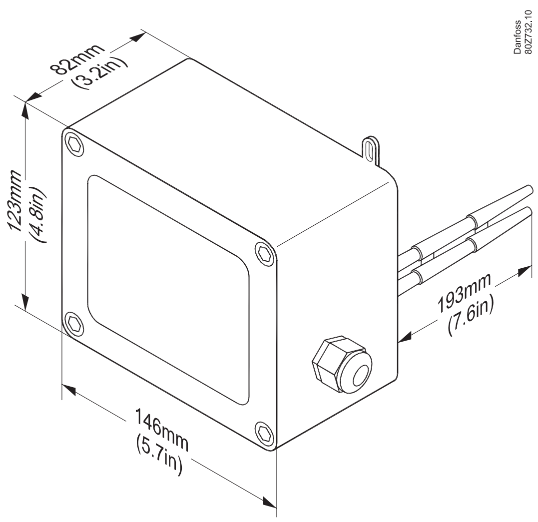
**IP66 Airflow Duct Mount Housing**

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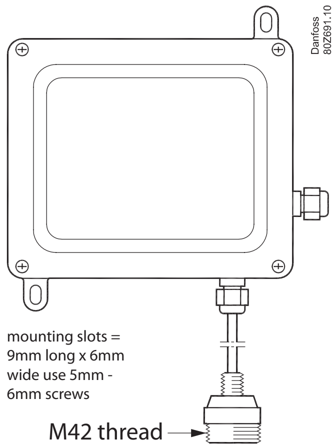
**IP66 Housing with Remote Sensor Head**

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# 4. Installation and Wiring

**WARNING** Explosion hazard! Do not mount the DGS Modbus in an area that may contain flammable liquids, vapors, or aerosols. Operation of any electrical equipment in such an environment constitutes a safety hazard.

**CAUTION** The DGS contains sensitive electronic components that can be easily damaged. Do not touch nor disturb any of these components.

**NOTE** The mounting location of the monitor should allow it to be easily accessible for visual monitoring and servicing.

**NOTE** The monitor must be connected by a marked, suitably located and easily reached switch or circuit-breaker as means of disconnection

**NOTE** Connect monitor power and signaling terminals using wiring that complies with local electrical codes or regulations for the intended application.

**NOTE** This instrument can be equipped with a semiconductor sensor for the detection of refrigerant, combustible or VOC gases. Semiconductor sensors are not gas specific and respond to a variety of other gases including propane exhaust, cleaners, and solvents. Changes in temperature and humidity may also affect the sensor's performance.

## 4.1 Electrical connection and diagram

**NOTE**: The wiring is the same for the semi-conductor and infrared models. The controller wiring is the same for all controllers.

There is a 5-minute power-up delay to allow the sensor to stabilise. Also see section 5.
Refer to Figure 1 for internal components and wiring.

**Figure 1a. Sensor Components (IR sensor)**

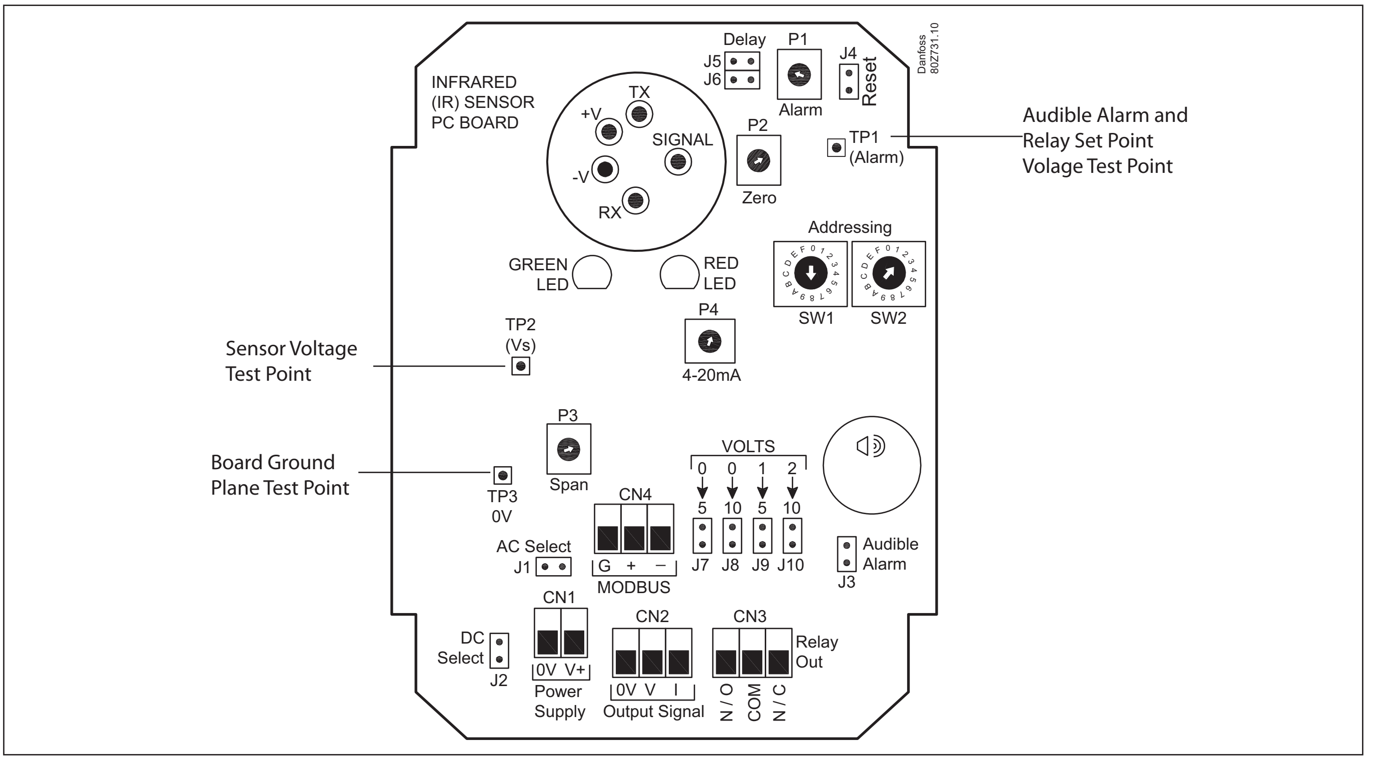
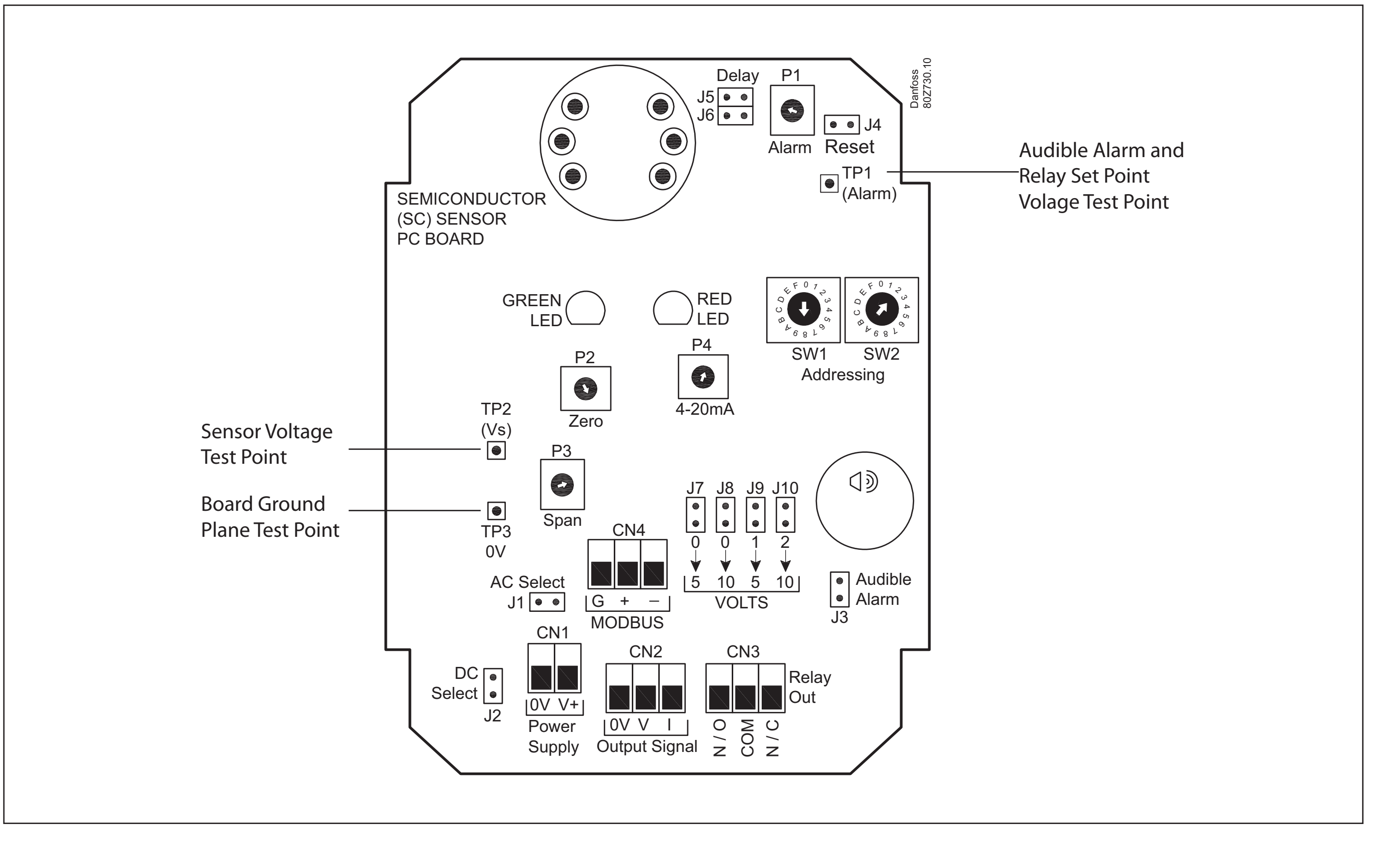
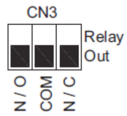
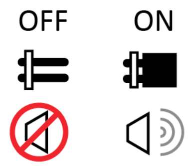
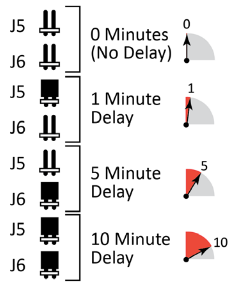
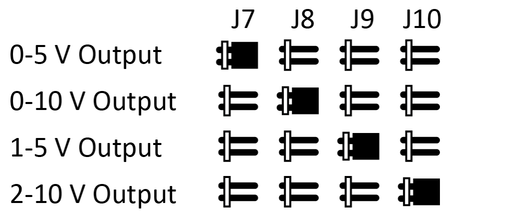



**Figure 1b. Sensor Components (SC Sensor)**



| Item | Description |
|---|---|
| Enclosure Access | **To open the IP41 Sensor enclosure:** turn the cable gland ½ turn anticlockwise to loosen the internal gland nut, depress the clip on top of the enclosure and open. Reverse to close.<br>With DGS-SC a retention strap fixates the sensor element during transportation. Remove it after opening the sensor enclosure by pulling the tap of the retention strap.<br>**IP66** is open and closed with a Torx size TX25. It is supplies without any retention strap. |
| Power | 12-24V AC/DC, connect at positions 0V and +V at connector block CN1.<br>• For AC: Jumper J1 is on, J2 is off.<br>• For DC: Jumper J1 is off, J2 is on. (Default factory setting is DC.)<br>Use 2 wires, typically 18 AWG (minimum). |
| Output | Connect two wires to terminal block CN2 positions 0V and V or I for voltage or current, respectively.<br>• Connect 4-20mA at CN2 positions 0V and I<br>• Connect voltage output at CN2 positions 0V and V |
| Alarm relay | The digital alarm output signal is connected at connector block CN3  <br><br>The alarm relay may be operated with or without fail safe function.<br>When the fail-safe function is enabled, the relay will give an alarm if the power is disconnected from the DGS unit.<br>Most products are supplied with the fail-safe function disabled (see separate Datasheet for details).<br>It is possible via the Modbus interface to disable and enable the fail-safe function.<br>N/O Normally Open When operated without fail-safe, the 'N/O' and 'COM' terminals are used.<br>COM Common<br>N/C Normally Closed When operated with fail-safe, the 'N/C' and 'COM' terminals are used. |
| Modbus (RS-485) | The Modbus connector is CN4.<br>G Ground Galvanically separated<br>- A (Rx/Tx) Modbus non-inverting signals<br>+ B (Tx/Rx) Modbus inverting signals<br>See section 4.4 for details on system integration. |

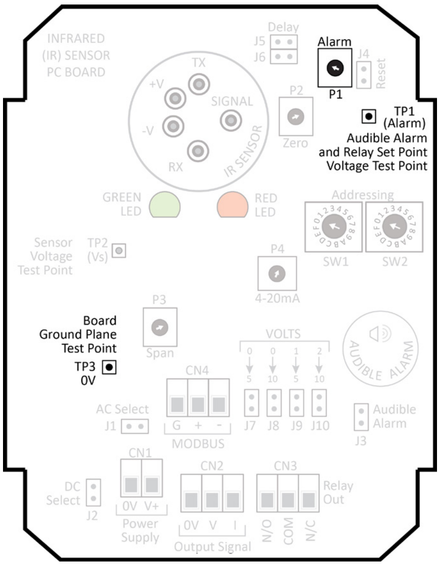
## 4.2 Jumper Configurations

| Function | Description | |
|---|---|---|
| **Input Power (J1, J2)** | Decide whether the device will be powered (via CN1) with an AC source or a DC source. See Figure 1 for jumper locations. |  |
| **Buzzer (J3)** | The unit has an internal audible alarm (see Figure 1). You can disable this alarm using jumper J3. The default setting is "enabled" in compliance with EN378. See Figure 1 for details. |  |
| **Reset (J4)** | This is a jumper used for changing the Modbus communication speed. See section 4.4 for details on system integration. | |
| **Time Delay (J5, J6)** | A time delay is available to avoid false alarms from the buzzer and relay. This is set with jumpers. The default delay is 0 minutes. The max setting via jumpers is 10 minutes. See Figure 1 for jumper locations.<br>Or the time delay is programmed via Modbus. See section 8.<br>A Modbus setting takes priority over the hardware setting (i.e. they might be different). |  |
| **DC Output Selection (J7-J10)** | Decide which DC voltage output range is required for the DC output signal on connector CN2. See Figure 1 for jumper locations. |  |

## 4.3 Adjusting the Alarm Setpoint

The alarm setpoint may be changed physically via the potentiometer P1 (see below) or through the Modbus interface (see section 7).
If the Modbus setting takes a value different than '0' (zero), the Modbus setting takes priority.
As default the potentiometer setting takes priority (that is, the default Modbus setting is '0' (zero)

For all DGS gas detectors the process to adjust the alarm setpoint via the potentiometer and test points 'TP3 0V' and 'TP1 (Alarm) is the same.
See Figure 1 for locations.

<table>
<tr><th>Function</th><th colspan="2">Description</th></tr>
<tr><td>1</td><td>Locate P1 and use it to adjust the set point at which the relay activates.</td><td rowspan="2">
</td></tr>
<tr><td>2</td><td>Using a volt meter, monitor the output between test points 0V (negative) and ALARM (positive) until the correct setting is reached. See formula below for example of how to calculate the desired setpoint.<br><br>$$\text{Voltage} = \text{Alarm Value} \times \frac{5\text{ V}}{\text{Max Range}}$$<br>Voltage: The potentiometer is adjusted until this signal is measured between the test points<br>Alarm value: The ppm level at which the sensor must signal an alarm on the relay and on Modbus<br>Max range: The maximum measurement range of the particular DGS sensor<br><br>Example: For a sensor range of 0-1000 ppm, calculate the voltage to set the alarm point at 100 ppm.<br><br>$$\text{Voltage} = 100\text{ ppm} \times \frac{5\text{ V}}{1000\text{ ppm}} = 0.5\text{ V}$$<br>So the alarm voltage setting is 0.5 Volts.<br><br>**NOTE**: The output changes when changing P1. It does not change when changing the Modbus value.</td></tr>
</table>

Alternatively this may be set via Modbus directly in ppm or % of full scale.
See section 7 for details.

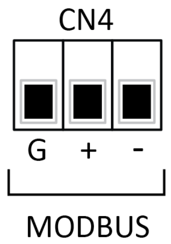
**NOTE**: A Modbus setting takes priority over the hardware setting. If needed set the Modbus value to zero to re-activate the hardware setting.

⚠ For R449A the maximum allowed alarm setpoint is 500 ppm.

## 4.4 System integration

**Modbus connection**

Connector CN4 (labeled G, +, and -) is an RS-485 port for communicating with DGS Modbus gas detectors in Modbus-RTU protocol.




G — Ground (Galvanically separated)

\+ — Non-inverting Modbus Signal (A) TxD+/Rxd+

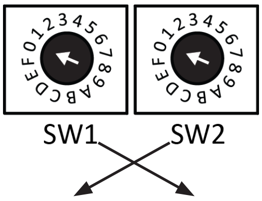
\- — Inverting Modbus Signal (B) TxD-/Rxd-

**Modbus Address**

To establish Modbus communication to Danfoss front end, configure the address using SW1 and SW2 and perform a network scan from the front end.
The Baud rate may need changing. It must be set to 19,200 baud when used with AK-SM 720/AK-SM 350 and when AK-SM 800 is configured in SLV-mode (see manual for AK-SM 800 for further details).
As default the AK-SM 800 communicate at the same baudrate as DGS.
The Hexadecimal Address Switches are used to set a unique address for the sensor. Valid addresses are 0-247.
The Modbus address can be set by the combined settings on the hexadecimal dial switches SW1 and SW2. Addresses 0-15 are selectable with switch SW1 (the least significant portion of the address). SW2 scales the addresses by a factor of 16 (the most significant portion of the address).

ADDR = 16 x SW2 + SW1
Example: 40 = 16 x 2 + 8

SW1 = Least Significant Hex Character (0-F) = 0-15
SW2 = Most Significant Hex Character (0-F) = 0-15





| ADDR | SW2 | SW1 |
|---|---|---|
| 1 | 0 | 1 |
| 2 | 0 | 2 |
| 3 | 0 | 3 |
| : | : | : |
| 9 | 0 | 9 |
| 10 | 0 | A |
| 11 | 0 | B |
| : | : | : |
| 15 | 0 | F |
| 16 | 1 | 0 |
| : | : | : |
| 246 | 6 | F |
| 247 | 7 | F |

See appendix B for complete list of all address'

**NOTE:** Addresses 0 and 248-255 (0x8F – 0xFF) are reserved.

**Baud rate**

To choose a Baud rate, select the address and reset the gas detector by temporarily shorting jumper J4 (or by cycling the power off and on). After the Baud rate is set, the desired Modbus address (1-247) can be selected by changing the switch settings with a power-cycle or reset operation afterwards.

Addresses 253 (0xFD) to 255 (0xFF) are reserved for setting the Modbus communications Baud rates.

| ADDR | S2 | S1 | BAUD RATE | |
|---|---|---|---|---|
| 254 | F | E | 9,600 | |
| 255 | F | F | 19,200 | |
| 253 | F | D | 38,400 | (Default) |

**NOTE:** The default Baud rate is 38,400.

# 5. Operation and Stabilisation

**Stabilisation**
On powering up it will sense for the presence of gas after an initial warmup delay of 5 minutes. A Modbus service parameter is set during the warm-up.

The typical time for various sensor types to stabilise is shown below.

| Sensor Type | Stabilisation Time |
|---|---|
| Semiconductor (SC) | 5 minutes |
| Infrared (IR) | 2 minutes |

On power up, semiconductor sensors output a signal voltage that is over the + max scale, i.e., > 5V, and move towards zero as they stabilise.

If sensors have been in long-term storage or the detectors have been turned off for a long period, stabilisation is much slower. However, within 1-2 hours sensors should have dropped below the alarm level and be operational. You can monitor progress exactly by monitoring the output (for example, 0-10V, or as otherwise configured). When the output settles around zero the sensor is stabilised. In exceptional circumstances the process can take up to 24 hours or more.

**Alarm condition**
In alarm condition: (e.g. high gas level)

- the green LED stays on
- the red LED will be on
- the buzzer operates (if it has not been disabled and after a delay if this option has been selected)
- the relay output activates (after a delay if this option has been selected)
- the "Limit alarm" and "Warning limit al" is activated as applicable (after a delay if this option has been selected)
- the voltage or current output changes proportional to gas concentration

**Fault condition**
In fault condition: (e.g. sensing error)

- the green LED will be off
- the red LED will be on
- the applicable Modbus alarm is activated
- a voltage or current fault output will activate
  2mA on the 4-20mA output
  0.5V on the 1-5V output
  1.0V on the 2-10V output

**Manual control**
It is possible to perform a manually control to verify the buzzer, LED's and alarm relay, see Section 7.

# 6. Functional Tests and Calibration

## 6.1 Introduction

To comply with the requirements of EN378 and the European F-GAS regulation, sensors must be tested annually. However, local regulations may specify the nature and frequency of this test.

*NOTE: The DGS Modbus is calibrated at the factory. After installation, a zero adjustment may be required to DGS-SC due to differences in environmental conditions. DGS-IR should never need any adjustment after installation.*

⚠
**CAUTION**: Check local regulations on calibration or testing requirements.

⚠
**CAUTION**: The DGS Modbus contains sensitive electronic components that can be easily damaged. Do not touch nor disturb any of these components while lid is removed and when replacing it.

**IMPORTANT**: If the DGS-SC is exposed to a large leak it should be tested to ensure correct functionality by electrically resetting the zero setting and carrying out a bump test. See procedures below. This does not apply to DGS-IR.

**IMPORTANT**: Danfoss recommends annual checks and gas calibration. Danfoss also recommends sensor replacement every 3 years or as required. Calibration frequency may be extended based on application, but should never exceed 2 years.

**IMPORTANT**: In applications where life safety is critical, calibration should be done quarterly (every 3 months) or on a more frequent basis. Danfoss is not responsible for setting safety practices and policies. Safe work procedures including calibration policies are best determined by company policy, industry standards, and local codes.

**IMPORTANT**: Failure to test or calibrate the unit in accordance with applicable instructions and with industry guidelines may result in serious injury or death. The manufacturer is not liable for any loss, injury, or damage arising from improper testing, incorrect calibration, or inappropriate use of the unit.

**IMPORTANT**: Before testing the sensors on-site, the DGS Modbus must have been powered up and allowed to stabilise. See section 5.

**IMPORTANT**: The testing and/or calibration of the unit must be carried out by a suitably qualified technician, and must be done:
• in accordance with this manual
• in compliance with locally applicable guidelines and regulations.

Suitably qualified operators of the unit should be aware of the regulations and standards set down by the industry/country for the testing or calibration of this unit. This manual is only intended as a guide and, insofar as permitted by law, the manufacturer accepts no responsibility for the calibration, testing, or operation of this unit.

The frequency and nature of testing or calibration may be determined by local regulation or standards.
EN378 and the F-GAS Regulation require an annual check in accordance with the manufacturer's recommendation.

There are two concepts that need to be differentiated:
• bump test
• calibration.

Bump Test:
Exposing the sensor to a gas and observing its response to the gas. The objective is to establish if the sensor is reacting to the gas and all the sensor outputs are working correctly. There are two types of bump test.

| | |
|---|---|
| Quantified: | A known concentration of gas is used. |
| Non-Quantified: | A gas of unknown concentration is used. |

Calibration:
Exposing the sensor to a calibration gas, setting the "zero" or standby voltage to the span/range, and checking/adjusting all the outputs, to ensure that they are activated at the specified gas concentration.

⚠
**CAUTION**: Before you carry out the test or calibration:
• Advise occupants, plant operators, and supervisors.
• Check if the DGS Modbus is connected to external systems such as sprinkler systems, plant shut down, external sirens and beacons, ventilation, etc. and disconnect as instructed by the customer.
• Deactivate alarm delays if selected at JP5, JP6 as per Figure 1 or via Modbus. See section 7.
• For bump test or calibration the DGS Modbus should be powered up overnight. The instrument should be fully stabilised per Section 5.

## 6.2 Bump Testing

After installation, the units should be bump tested. Expose the sensors to test gas (R134A, $CO_2$, etc.). The gas should put the system into alarm and light the red LED. The delay prevents the audible alarm from sounding, the relay from switching and the alarm from activating on Modbus.
With a bump test you can see the functions of the sensor - the red LED will light, the relay and audible alarm will function, and the output (0 - 10V, for example) will show the gas level.
Ideally bump tests are conducted on site in a clean air atmosphere.

**NOTE**: Prior to carrying out a bump test, check and adjust the zero setting as described in the Calibration section.

**NOTE**: Procedures for bump test and calibration vary depending on the sensor technology used and the gas in question. The DGS Modbus is available in two sensor versions: Semiconductor (SC) and Infrared (IR).

**NOTE**: Do not pressurise the sensor.

**NOTE**: For semiconductor sensors, you MUST use calibration gas in a balance of air (not $N_2$).

**IMPORTANT**: After a semiconductor sensor is exposed to a substantial gas leak, the sensor should be zero calibrated and bump tested and replaced if necessary.

**NOTE**: To test the audible alarm and/or relay function, check the delay is set at zero and expose to gas. You can mute the audible alarm by removing jumper J3.

| Step | Bump Testing Using Calibration Gas Cylinders |
|---|---|
| 1 | Remove the enclosure lid of the gas detector (not in an exhaust area). |
| 2 | Connect a voltmeter to monitor sensor response. Monitor response (0-5V) between pins 0V (TP3) and Vs (TP2). |
| 3 | Expose the sensor to gas from the cylinder. Use a plastic hose/hood to direct gas to the sensor head. A response of above 80% is acceptable. |

**NOTE**: Gas ampoules are not valid for calibration or accuracy checks of the sensor. These require actual gas calibration, not bump testing with ampoules.

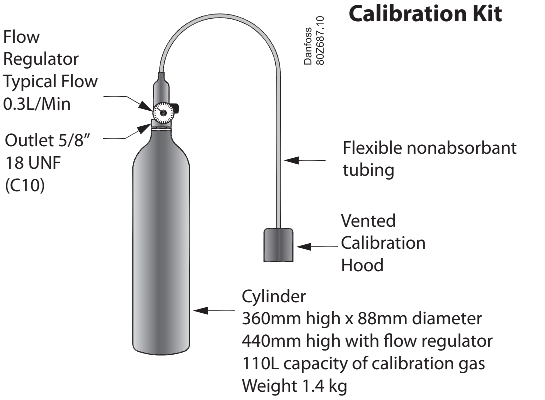



Figure 6. Gas Cylinder and Test Hardware

Gas ampoules are convenient and inexpensive alternatives to using gas cylinders for bump testing.

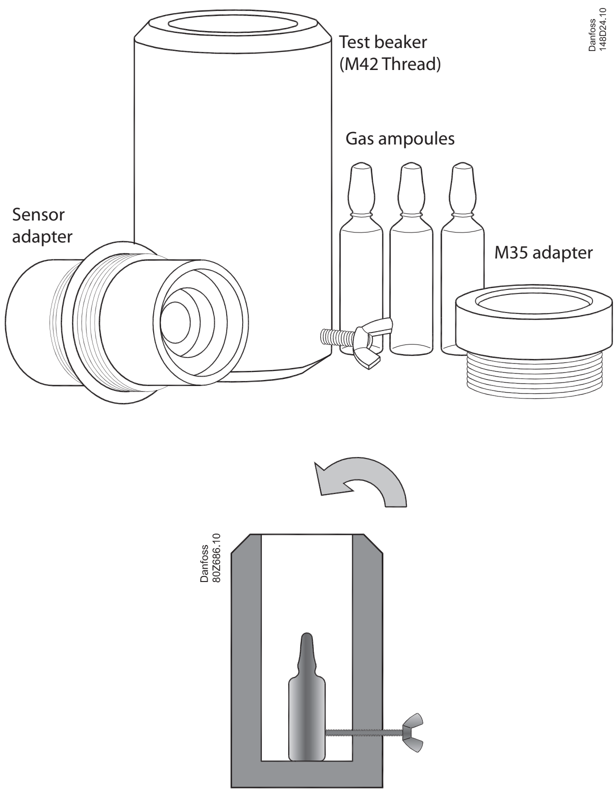



Figure 7. Gas Ampoules for Bump Testing

| Step | Bump Testing Using Gas Ampoules |
|---|---|
| 1 | Make sure that both the ampoules and the calibration beaker are clean and dry. |
| 2 | Unscrew the beaker hold screw and place the ampoule so that it sits in the base of the beaker (see Figure 7). |
| 3 | Tighten wing-nut screw onto the ampoule without breaking it. |
| 4 | Remove the enclosure lid of the gas detector. |
| 5 | Connect a voltmeter to monitor sensor response. Monitor response (0-5V) between pins 0V (TP3) and Vs (TP2). |
| 6 | Place the beaker over the sensor head using the multi sensor adaptor to fit the sensor, or, if an Exd, IP66 or Remote sensor head version, screw the beaker on the remote sensor head M42 thread or M35 thread adaptor. It should be as tight fitting as possible to allow maximum gas exposure. |
| 7 | Tighten the wing-nut screw onto the ampoule until it shatters allowing the gas to diffuse in the beaker. It should be left in place for approximately 5 min. |
| 8 | The voltage output will increase. This confirms that the sensor is responding. A response equivalent to at least 50% of the test gas (typical) will confirm that the system is in order. |
| 9 | Remove the beaker from the sensor. Carefully remove any ampoule remains from the gas detector and beaker. |

## 6.3 Calibration Overview

There are two adjustments required: zero and span. They are monitored at testpoint TP2 and TP3 using a 0-5V scale. See fig. 1. If the sensor range is 0-1000 ppm, then 5V=1000 ppm.

Tools required:
- Gas cylinder with the appropriate gas and concentration
- Calibration kit
- A voltmeter (crocodile clips recommended)
- Screwdriver (depending on housing).

Danfoss offers calibration gasses and a kit that consists of a flow regulation valve with flexible non-absorbent tubing and vented calibration hood. (see fig. 6).

**NOTE**: For improved accuracy and response, the instrument should be zeroed and calibrated in the environment in which it is being installed.

## 6.4 Calculating Calibration Voltage

Sensor outputs are linear. As long as you have a gas cylinder of known concentration you can calibrate to any desired range*. However, for maximum accuracy calibrate with a gas close to the alarm set point.
Example: For a sensor range of 0-1000 ppm and a cylinder of the target gas at 800 ppm:

$$\text{Voltage} = \text{Target Gas Value} \times \frac{5\text{ V}}{\text{Sensor Range}}$$

$$\text{Voltage} = 800\text{ ppm} \times \frac{5\text{ V}}{1000\text{ ppm}} = 4\text{ V}$$

So the output voltage signal should be adjusted to 4V.

*For R449A only: This gas is nonlinear above 500ppm. Calibration must be done with a 500 ppm gas. Any readings above 500ppm must be regarded as in-valid. 500ppm is also the maximum allowed alarm threshold for this gas.

## 6.5 Calibrating Semiconductor (SC) Sensors

| Step | Calibrating Semiconductor (SC) Sensors |
|---|---|
| 1 | Locate P2 which is used to adjust the zero point. |
| 2 | Monitor the output between 0V (TP3) and Vs (TP2). |
| 3 | Expose sensor to zero air until output is stable (typically 3-5 minutes). |
| 4 | Adjust P2 until the voltmeter reads a slightly positive value (0.01 V is acceptable). |
| 5 | Locate P3 which is used to calibrate the range (span) of the sensor. |
| 6 | Expose the sensor to calibration gas and allow to stabilise (typically 3-5 minutes). |
| 7 | Adjust P3 until the voltmeter equals the voltage calculated in section 6.4 |

**NOTE:** For semiconductor sensors, you MUST use calibration gas in a balance of air (*not* $N_2$).

## 6.6 Calibrating Infrared (IR) Sensors

| Step | Calibrating Infrared (IR) Sensors |
|---|---|
| 1 | Locate P2 which is used to adjust the zero point. |
| 2 | Monitor the output between 0V (TP3) and Vs (TP2). |
| 3 | Expose the sensor to nitrogen or zero air until output is stable (typically 3-5 minutes). |
| 4 | Adjust P2 until the voltmeter reads 0 V or slightly positive (0.01 V is acceptable). |
| 5 | Locate P3 which is used to calibrate the range (span) of the sensor. |
| 6 | Using the appropriate calibration hood for the sensor, expose the sensor to calibration gas and allow to stabilise (typically 3-5 minutes). |
| 7 | Adjust P3 until the voltmeter equals the voltage calculated in section 6.4 |

## 6.7 Calibration of alarm setpoint

See section 4.3

## 6.8 Calibration of 4-20mA output

For improved accuracy of the 4-20mA output it is possible to zero adjust this separately. This is done by adjusting the potentiometer P4 until the output corresponds to the gas concentration:

$$\text{Current} = 4\text{mA} + \text{gas concentration} \times \frac{16\text{ mA}}{\text{Sensor Range}}$$

Example for a sensor range of 0-1000ppm and a gas concentration of 800ppm:

$$\text{Current} = 4\text{mA} + 800\text{ ppm} \times \frac{16\text{mA}}{1000\text{ ppm}} = 16.8\text{mA}$$

## 6.9 Issue Test certificate

See example in appendix C

# 7. Installation

To install the DGS unit on the network, first set the network address (see section 4.4 of this manual). Following this, the DGS unit can be installed on the network and configured in the Front End. (see Front End manual for specific details)
For communication speeds other than the default 38.4k, please refer to section 4.4 of this manual and the manual of the system manager.

## Survey of functions

SW 1.1x

| Function | Parameter by operation via data communication |
|---|---|
| **Gas level** | |
| Actual gas level in %<br>The actual gas level is displayed here as a percentage of the full scale ppm. The full scale ppm can be viewed in the "Service" group.<br>Example: If the full scale value is 1000ppm and the sensor is measuring 400ppm, the value is 40% | Gas level %<br>(shown in all menu displays) |
| Actual gas level in ppm<br>The actual gas level is displayed here as a ppm value. | Gas level ppm<br>(shown in all menu displays) |
| **Alarms** | **Alarm settings** |
| As default the potentiometer in the DGS unit defines the alarm limit (see section 4.3) and the warning function is disabled.<br>By changing the value of the "Alarm Limit" parameter, the alarm parameter defines the alarm limit and the Warning function can be enabled.<br>Changing the alarm limit parameter to zero will enable the potentiometer alarm setting and disable the warning function. The potentiometer value is read back to the Alarm Limit parameter and presented (zero is overwritten).<br>It is not possible to adjust the alarm limit below the actual warning limit.<br>It is not possible to adjust the warning limit above the actual alarm limit.<br>If this is attempted, the value is considered invalid and ignored. | |
| **Critical alarm indication**<br>Common indication of alarms (any alarms active excl. warnings)<br>The indication is given as soon as the alarm condition is present regardless of any alarm time delays<br>0 = No active alarm(s)<br>1 = Alarm(s) active | GD alarm |
| **General alarm incication**<br>Common indication of any alarms incl. warnings<br>The indication is given as soon as the alarm condition is present regardless of any alarm time delays<br>0 = No active alarm(s) or warning(s)<br>1 = Alarm(s) or warning(s) active | Common errors |
| **Alarm limit in %**<br>The alarm limit can be set as a percentage of full scale ppm. The full scale ppm can be viewed in the "Service" group.<br>Example: If the full scale value is 1000ppm and the sensor should give alarm at 500ppm, the value is entered as 50% | Alarm limit % |
| **Alarm limit in ppm**<br>The alarm limit is entered here as a ppm value. | Alarm limit ppm |
| **Time delay for level alarms**<br>High alarm delay in minutes.<br>If set to 0, the hardware jumper configuration is used. This means that the hardware configured delay will be shown (zero is overwritten).<br>If set to a value above zero, this value is used instead of the hardware jumper configuration.<br>The value is used both as delay for limit alarm and warning. | Alarm delay |
| **Reset alarm in DGS unit**<br>Will mute the buzzer and reset the alarm relay. The alarm remains active (LED and Modbus) until the alarm condition disappears. | Reset alarm |

| | |
|---|---|
| **Duration of Reset alarm**<br>Maximum duration of alarm reset before automatic re-enable of external indicators (mute timeout in minutes) a value of 0 disables ability to mute alarm.<br>The duration time is set in minutes | Reset alarm time |
| **Warning limit in %**<br>The warning limit can be set as a percentage of full scale ppm. The full scale ppm can be viewed in the "Service" group.<br>Example: If the full scale value is 1000ppm and the sensor should give alarm at 200ppm, the value is entered as 20% | Warning limit % |
| **Warning limit in ppm**<br>The warning limit is entered here as a ppm value. | Warning lim. ppm |
| **Enabling of Warning alarm**<br>It is possible to enable a warning alarm to give an early indication of a potential high alarm limit.<br>Enables warning alarm when the Warning limit is exceeded | Warning Enable |
| **Service** | **Service** |
| **Refrigerant type**<br>Read out of refrigerant (Gas) used for the for the DGS is used for | Refrigerant |
| **Gas Full scale in ppm**<br>The full scale ppm value is displayed here | Fullscale ppm |
| **Hours since last calibration**<br>Keeps a count of the number of hours the sensor is powered on. The value is incremented every hour and after one year the register will exceed 8760 hours and the Calibrate Sensor alarm is set to indicate that the detector requires testing. The "Reset Cal" is used to reset both the alarm and the "Burning Hours" timer. | Burning hours |
| **Status of the sensor warm up period**<br>Depending on the sensing technology of the actual DGS unit, it will have a warm-up period of up to 5 minutes until the measurements are accurate<br>0 =Ready<br>1 = Warming Up | Startup flag |
| **Reset calibration counter and warning**<br>Clears calibration due warning and resets the burning hours parameter to zero<br>0 = Calibration valid<br>1 = Calibration due | Reset cal |
| **Alarm relay Failsafe configuration**<br>The alarm relay function can be configured to give an alarm when the DGS unit is powered off.<br>0 = Not failsafe<br>1 = Failsafe | Relay failsafe |
| **Enable Manual control**<br>In a service situation it is possible to set the DGS unit in a manual control mode to validate the installation.<br>As a pre-caution, the DGS unit automatically changes back from manual control to normal operation after 10 minutes | Maunal Control |
| **Status of the alarm relay**<br>Displays the status of the alarm relay<br>Can be operated in Manual Control mode<br>0 = No alarm signal<br>1 = alarm signal | Alarm Relay |
| **Status of the buzzer**<br>Displays the status of the buzzer.<br>Can be operated in Manual Control mode<br>0 = inactive<br>1 = active | Sounder |
| **Status of the red LED**<br>Displays the status of the red LED (unit in alarm condition).<br>Can be operated in Manual Control mode<br>0 = off<br>1 = on | Red LED |
| **Status of the green LED**<br>Displays the status of the green LED (unit powered ON).<br>Can be operated in Manual Control mode<br>0 = off<br>1 = on | Green LED |

| Alarms | |
|---|---|
| When an alarm condition becomes present, the red LED is lid immediately.<br>If a delay is configured for a given alarm, the buzzer, alarm relay and Modbus alarm are set active after the delay has expired. | |
| Critical alarm for high gas level | Limit alarm |
| The gas level exceeds the full-scale value. Likely the sensor element needs replacing | Sensor saturated |
| The signal from the sensor is missing (sensor element defect or removed) | Sensor out |
| DGS unit due for calibration as it has been operating for 1 year or more | Calibrate sensor |
| Warning alarm for high gas level | Warning limit al. |

## Menu Survey

| Function | Min | Max | Factory | Unit | AKM name |
|---|---|---|---|---|---|
| **Gas level** | | | | | |
| Actual gas level in % | 0.0 | 100.0 | 0.0 | % | Gas level % |
| Actual gas level in ppm **(OBS note [1])** | 0 | FS[2] | 0 | ppm | Gas level ppm |
| **Alarms** | | | | | **Alarm settings** |
| Common indication of alarms (any alarms active excl. warnings)<br>0 = No active alarm(s)<br>1 = Alarm(s) active | 0 | 1 | 0 | - | GD alarm |
| Common indication of both alarms incl. warnings<br>0 = No active alarm(s) or warning(s)<br>1 = Alarm(s) or warning(s)) active | 0 | 1 | 0 | - | Common errors |
| Alarm limit in % | 0.0 | 100.0 | 0.0 | % | Alarm limit % |
| Alarm limit in ppm | 0 | FS[2] | 0 | ppm | Alarm limit ppm |
| High alarm delay in minutes, if set to 0 hardware jumper configuration is used (hardware configured delay will be shown). If set to value, software alarm delay is used. | 0 | 10 | 0 | min. | Alarm delay |
| When set to 1, the alarm relay and sounder are reset to no alarm indication (mute a connected indicator). When the alarm is reset or the timeout duration is exceeded, the value is reset to 0.<br>OBS: The alarm condition is not reset only the relay indication is reset. Used to mute an external alert (audible/visible)<br>0 = Alarm outputs not muted<br>1 = Alarm outputs muted | 0 | 1 | 0 | - | Reset alarm |
| Maximum duration of alarm reset before automatic re-enable of external indicators (mute timeout in minutes) a value of 0 disables ability to mute alarm. | 0 | 59 | 0 | min | Reset alarm time |
| Warning limit in % | 0.0 | 100.0 | 0.0 | % | Warning limit % |
| Warning limit in ppm | 0 | FS[2] | 0 | ppm | Warning lim. ppm |
| Enables warning alarm when Warning limit exceeded | 0 | 1 | 0 | min. | Warning Enable |

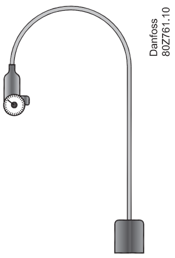
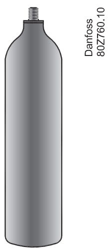
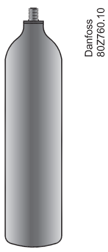
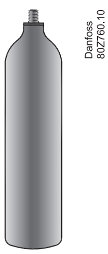
[1] The communication system can only handle integer values in the range -32000 to 32000 and decimal values in the range -3200.0 to 3200.0.

[2] Value equals fullscale range of specific product

| Service | | | | | |
|---|---|---|---|---|---|
| Read out of refrigerant (Gas) for the DGS is used for<br>Value according to "Danfoss standard list". | 1 | 42 | N | - | Refrigerant |
| Gas Full scale in ppm | 0 | 32000 | 0 | ppm | Fullscale ppm |
| Hours since last calibration | 0 | 32000 | 0 | hours | Burning hours |
| Status of the sensor warm up period<br>0 =Ready<br>1 = Warming Up | 0 | 1 | 0 | - | Startup flag |
| When cleared,  clears calibration due alarm and resets the burning hours parameter<br>0 = Calibration valid<br>1 = Calibration due | 0 | 1 | 0 | - | Reset cal |
| Failsafe operation of the Relay<br>0 = Not failsafe<br>1 = Failsafe | 0 | 1 | 0 | - | Relay failsafe |
| Enables Manual control of Relays.<br>Automatically falls back to Off after 10 min. | 0 | 1 | 0 | - | Maunal Control |
| Status of the high alarm relay<br>0 = No alarm signal<br>1 = alarm signal | 0 | 1 | 0 | - | Alarm Relay |
| Status of the buzzer<br>0 = inactive<br>1 = active | 0 | 1 | 0 | - | Sounder |
| Status of the red LED<br>0 = off<br>1 = on | 0 | 1 | 0 | - | Red LED |
| Status of the green LED<br>0 = off<br>1 = on | 0 | 1 | 0 | - | Green LED |
| **Alarms** | | | | | |
| Limit alarm<br>0 = Alarm not active<br>1 = Alarm, gas limit exceeded | 0 | 1 | 0 | - | Limit alarm |
| Sensor saturated<br>0 = OK<br>1 = Fault. Out of range under test | 0 | 1 | 0 | - | Sensor saturated |
| Sensor out<br>0 = OK, sensor in place<br>1 = Fault, Sensor out or removed | 0 | 1 | 0 | - | Sensor out |
| Calibrate sensor<br>0 = OP, Sensor not due for calibration<br>1 = Warning, Due for calibration | 0 | 1 | 0 | - | Calibrate sensor |
| Warning limit alarm<br>0 = OK, Gas level below warning level<br>1 = Warning, Gas level above warning level and delay expired | 0 | 1 | 0 | - | Warning limit al. |

# 8. Accessories

Accessories for calibration

| | | Code no |
|---|---|---|
|   | Calibration kit (excl. gas) | **080Z2296** |
|   | 110l cylinder with 10.000 ppm $CO_2$ | **080Z2297** |
|   | 110l cylinder with 100% $N_2$ | **080Z2298** |
|   | 110l cylinder with 5.000 ppm $CO_2$ | **080Z2299** |

# 9. Troubleshooting

| Symptom | Possible Cause(s) |
|---|---|
| Green and Red light off | • Check power supply. Check wiring.<br>• DGS Modbus was possibly damaged in transit. Check by installing another DGS Modbus to confirm the fault. |
| Red light on, green led off (indicates a fault) | • Sensor may be disconnected from printed circuit board. Check to see sensor is properly inserted into board.<br>• The sensor has been damaged or has reached the end of life and needs to be exchanged. Contact Danfoss for instructions and support<br>• The zero-adjustment has been reduced to achieve a zero-measurement in an environment with gas, typically $CO_2$. Do a zero-adjustment with a zero-gas and a re-calibration. |
| Alarms in the absence of a leak | • If you experience alarms in the absence of a leak, try setting an alarm delay.<br>• Perform a bump test to ensure proper operation. |
| The zero-measurement drifts | The DGS-SC sensor technology is sensitive to the environment (temperature, moist, cleaning agents, gas' from trucks, etc). All ppm measurements below 75ppm should be disregarded, i.e. no zero-adjustment made. |
| When changing potentiometer P1, the test point measurement is changing but the active alarm point is not changing | Any alarm limit configured via Modbus takes priority over the setpoint set electrically via potentiometer P1. To re-enable the setpoint adjustment via P1, set the Modbus parameter to '0' (zero). |

# Appendix A

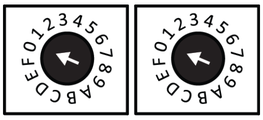
**Supported Air flows and Duct Sizes for the Duct Mount Housing**

| **Units** | **Duct Sizes** | | | | |
|---|---|---|---|---|---|
| inches | 12 x 12 | 12 x 24 | 18 x 18 | 24 x 24 | 24 round |
| feet | 1 x 1 | 1 x 2 | 1.5 x 1.5 | 2 x 2 | 3.14 x 1 x 1 |
| area (ft2) | 1 | 2 | 2.25 | 4 | 3.14 |
| **CFM*** | **Ft/min (Based on CFM* and Duct Size)** | | | | |
| 2800 | 2800 | n/a | n/a | n/a | n/a |
| 3000 | 3000 | n/a | n/a | n/a | n/a |
| 3400 | 3400 | n/a | n/a | n/a | n/a |
| 3800 | 3800 | n/a | n/a | n/a | n/a |
| 4000 | 4000 | n/a | n/a | n/a | n/a |
| 4400 | 4400 | n/a | n/a | n/a | n/a |
| 4800 | 4800 | n/a | n/a | n/a | n/a |
| 5000 | 5000 | 2500 | n/a | n/a | n/a |
| 5400 | 5400 | 2700 | n/a | n/a | n/a |
| 5800 | 5800 | 2900 | 2578 | n/a | n/a |
| 6000 | 6000 | 3000 | 2667 | n/a | n/a |
| 6400 | 6400 | 3200 | 2844 | n/a | n/a |
| 6800 | 6800 | 3400 | 3022 | n/a | n/a |
| 7000 | 7000 | 3500 | 3111 | n/a | n/a |
| 7400 | 7400 | 3700 | 3289 | n/a | n/a |
| 7800 | 7800 | 3900 | 3467 | n/a | n/a |
| 8000 | 8000 | 4000 | 3556 | n/a | 2548 |
| 8400 | 8400 | 4200 | 3733 | n/a | 2675 |
| 8800 | 8800 | 4400 | 3911 | n/a | 2803 |
| 9000 | 9000 | 4500 | 4000 | n/a | 2866 |
| 9400 | 9400 | 4700 | 4178 | n/a | 2994 |
| 9800 | 9800 | 4900 | 4356 | n/a | 3121 |
| 10000 | 10000 | 5000 | 4444 | 2500 | 3185 |

* CFM = Cubic Foot per Minute

# Appendix B

DGS Modbus addressing 1-120




SW1 SW2

| Ad. | SW1 | SW2 |
|---|---|---|
| 1 | 1 | 0 |
| 2 | 2 | 0 |
| 3 | 3 | 0 |
| 4 | 4 | 0 |
| 5 | 5 | 0 |
| 6 | 6 | 0 |
| 7 | 7 | 0 |
| 8 | 8 | 0 |
| 9 | 9 | 0 |
| 10 | A | 0 |
| 11 | B | 0 |
| 12 | C | 0 |
| 13 | D | 0 |
| 14 | E | 0 |
| 15 | F | 0 |
| 16 | 0 | 1 |
| 17 | 1 | 1 |
| 18 | 2 | 1 |
| 19 | 3 | 1 |
| 20 | 4 | 1 |

| Ad. | SW1 | SW2 |
|---|---|---|
| 21 | 5 | 1 |
| 22 | 6 | 1 |
| 23 | 7 | 1 |
| 24 | 8 | 1 |
| 25 | 9 | 1 |
| 26 | A | 1 |
| 27 | B | 1 |
| 28 | C | 1 |
| 29 | D | 1 |
| 30 | E | 1 |
| 31 | F | 1 |
| 32 | 0 | 2 |
| 33 | 1 | 2 |
| 34 | 2 | 2 |
| 35 | 3 | 2 |
| 36 | 4 | 2 |
| 37 | 5 | 2 |
| 38 | 6 | 2 |
| 39 | 7 | 2 |
| 40 | 8 | 2 |

| Ad. | SW1 | SW2 |
|---|---|---|
| 41 | 9 | 2 |
| 42 | A | 2 |
| 43 | B | 2 |
| 44 | C | 2 |
| 45 | D | 2 |
| 46 | E | 2 |
| 47 | F | 2 |
| 48 | 0 | 3 |
| 49 | 1 | 3 |
| 50 | 2 | 3 |
| 51 | 3 | 3 |
| 52 | 4 | 3 |
| 53 | 5 | 3 |
| 54 | 6 | 3 |
| 55 | 7 | 3 |
| 56 | 8 | 3 |
| 57 | 9 | 3 |
| 58 | A | 3 |
| 59 | B | 3 |
| 60 | C | 3 |

| Ad. | SW1 | SW2 |
|---|---|---|
| 61 | D | 3 |
| 62 | E | 3 |
| 63 | F | 3 |
| 64 | 0 | 4 |
| 65 | 1 | 4 |
| 66 | 2 | 4 |
| 67 | 3 | 4 |
| 68 | 4 | 4 |
| 69 | 5 | 4 |
| 70 | 6 | 4 |
| 71 | 7 | 4 |
| 72 | 8 | 4 |
| 73 | 9 | 4 |
| 74 | A | 4 |
| 75 | B | 4 |
| 76 | C | 4 |
| 77 | D | 4 |
| 78 | E | 4 |
| 79 | F | 4 |
| 80 | 0 | 5 |

| Ad. | SW1 | SW2 |
|---|---|---|
| 81 | 1 | 5 |
| 82 | 2 | 5 |
| 83 | 3 | 5 |
| 84 | 4 | 5 |
| 85 | 5 | 5 |
| 86 | 6 | 5 |
| 87 | 7 | 5 |
| 88 | 8 | 5 |
| 89 | 9 | 5 |
| 90 | A | 5 |
| 91 | B | 5 |
| 92 | C | 5 |
| 93 | D | 5 |
| 94 | E | 5 |
| 95 | F | 5 |
| 96 | 0 | 6 |
| 97 | 1 | 6 |
| 98 | 2 | 6 |
| 99 | 3 | 6 |
| 100 | 4 | 6 |

| Ad. | SW1 | SW2 |
|---|---|---|
| 101 | 5 | 6 |
| 102 | 6 | 6 |
| 103 | 7 | 6 |
| 104 | 8 | 6 |
| 105 | 9 | 6 |
| 106 | A | 6 |
| 107 | B | 6 |
| 108 | C | 6 |
| 109 | D | 6 |
| 110 | E | 6 |
| 111 | F | 6 |
| 112 | 0 | 7 |
| 113 | 1 | 7 |
| 114 | 2 | 7 |
| 115 | 3 | 7 |
| 116 | 4 | 7 |
| 117 | 5 | 7 |
| 118 | 6 | 7 |
| 119 | 7 | 7 |
| 120 | 8 | 7 |

# Appendix C
# DGS Test Certificate (Example)

(Download original from our web site **www.danfoss.com.** Use in Conjunction with the Danfoss Check Calibration Procedure)

**Product Description:** DGS **Serial Number**: 12345

**Date of First Calibration**: (see Rating Label) 25/10/05 **Date of Last Calibration**: 25/10/05

**Type/Range of Test Gas**: Cylinder 1000ppm R404a, batch no xxxx

## 1. Carry out Bump Test (set delay to zero)

✓

Power (Green LED) .......................................................... ☐

Visual Alarm (Red LED) .................................................. ☐

Sounder Operating .......................................................... ☐

Relay Operating .............................................................. ☐

Remote Systems if connected to relay ..................... ☐

**Check Analogue Output in Use, e.g.**

0 – 10V ................................................................................ ☐

System Passed ................................................................. ☐

If system failed, carry out a gas calibration. See below.

## 2. On site Gas Calibration (2 Yearly)

System Passed ................................................................. ☐

If the DGS did not respond correctly and could not be recalibrated due to age, exposure to gas etc, then either the DGS or the sensor element should be replaced (and recalibrated) and the test process repeated.

System Passed ................................................................. ☐

**We hereby certify that the above specified test procedure has been performed and the DGS is performing as specified.**

Test Performed by

______________________________ ______________________

Signature Date

ENGINEERING
TOMORROW