

Installation Guide

Danfoss Gas Sensor DGS MODBUS

ADAP-KOOL® Refrigeration Control System



DGS - Location instructions

Location of Sensors

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.

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, sensors should be mounted about head high (about 1.5 m [5 ft]).
With **CO₂** in a machinery room it is recommended to mount it 0.3 - 0.45 m (1 - 1.5 ft) above the floor as the air flow is low and CO₂ 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.

Refrigerated Spaces

In refrigerated spaces, sensors should be located in the return airflow to the evaporators on a sidewall (below head-high is preferred), not directly in front of an evaporator.

With **CO₂** in a machinery room it is recommended to mount it 0.3 - 0.45 m (1 - 1.5 ft) above the floor.

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.

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.

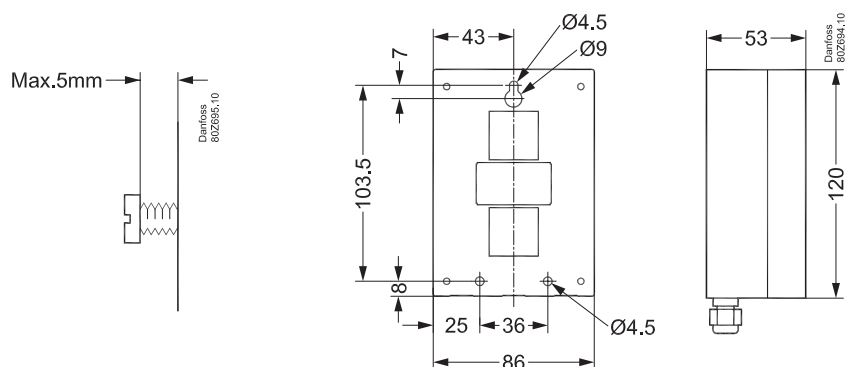
Weatherproof sensors should be used for unprotected outdoor applications.

Air Conditioning – Direct systems VRF/VRV

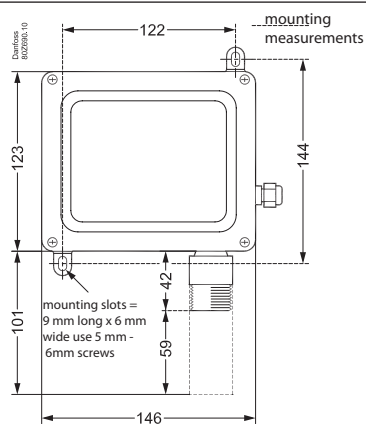
The DGS was not intended for use in occupied spaces (private housing, hotel rooms etc.) but may be used in such location. If so, special attention should be paid to ensure compliance with EN378.

Dimensions and mounting

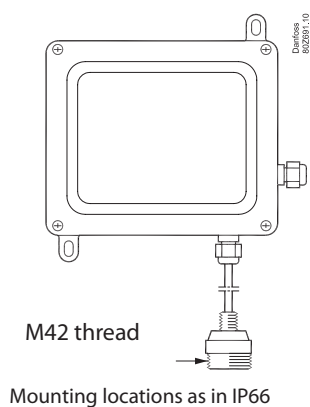
IP41 Sensor



IP66 sensor



IP66 Remote Head, M42 thread, 3m Cable



DGS Installation Instructions

Danfoss gas detectors can 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.

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.

A **retention strap** fixates the sensor element during transportation. Remove it after opening the sensor enclosure by pulling the tap of the retention strap.

IP66 is open and closed with a Torx size TX25. It supplies without any retention strap.

Power:

The DGS can be used with 12-24V AC/DC, connect at positions 0V and +V at connector block CN1.

Default factory setting is DC (J1 = OFF. J2 = ON)

To select AC set J1 = ON. J2 = OFF.

Sensor measurement

The sensor measurement is available as a current or voltage output through connector CN2. Current is measured between 0V and I as a 4-20mA signal, whereas the voltage output between 0V and V is configurable. Set J7, J8, J9 or J10 to ON to select 0-5V, 0-10V, 1-5V or 2-10V respectively. **Default factory setting is 1-5V.**

Alarm set point*: P1 sets the trip point for the relay and buzzer using the 0-5V scale (measure at test points TP3, 0V and TP1 alarm; 2.5V would be equivalent to half the range (500ppm on a scale of 0-1000ppm)). **Default factory setting** is typically around 50% of the full scale range but please refer to the label of the specific product for specific details.



For gas' with unlinear response to the semiconductor sensing technology, the maximum alarm threshold may be lower than the maximum measuring range. See data sheet or the product label for specific details

Time delay*: A time delay for the operation of the relay and buzzer can be selected using jumpers J5 and J6. **Default factory setting is zero.**

Time delay (min)	J6	J5
0 (default)	Off	Off
1	Off	On
5	On	Off
10	On	On

Buzzer: The buzzer can be disabled using jumper J3.

Default factory setting is enabled, which is in compliance with EN378.

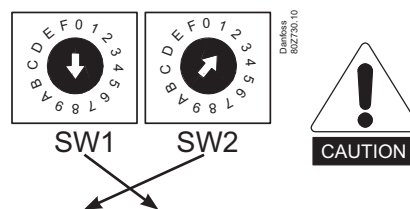
If you are connecting to a remote monitoring system the function may be disabled (buzzer).

* Note: The alarm setpoint and time delay are also configurable via the Modbus interface. If the Modbus parameters are set to zero (default) then the hardware configuration is active.

Network address

To establish Modbus communication, configure the address using SW1 and SW2 and perform a network scan from the front end. The Baud rate may need changing too, e.g. it must be set to 19,200 baud when used with AK-SM 720/AK-SM 350.

For further details on network integration, please refer to the Front End manual.



$$\text{ADDR} = 16 \times \text{SW2} + \text{SW1}$$

$$\text{Example: } 40 = 16 \times 2 + 8$$

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

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

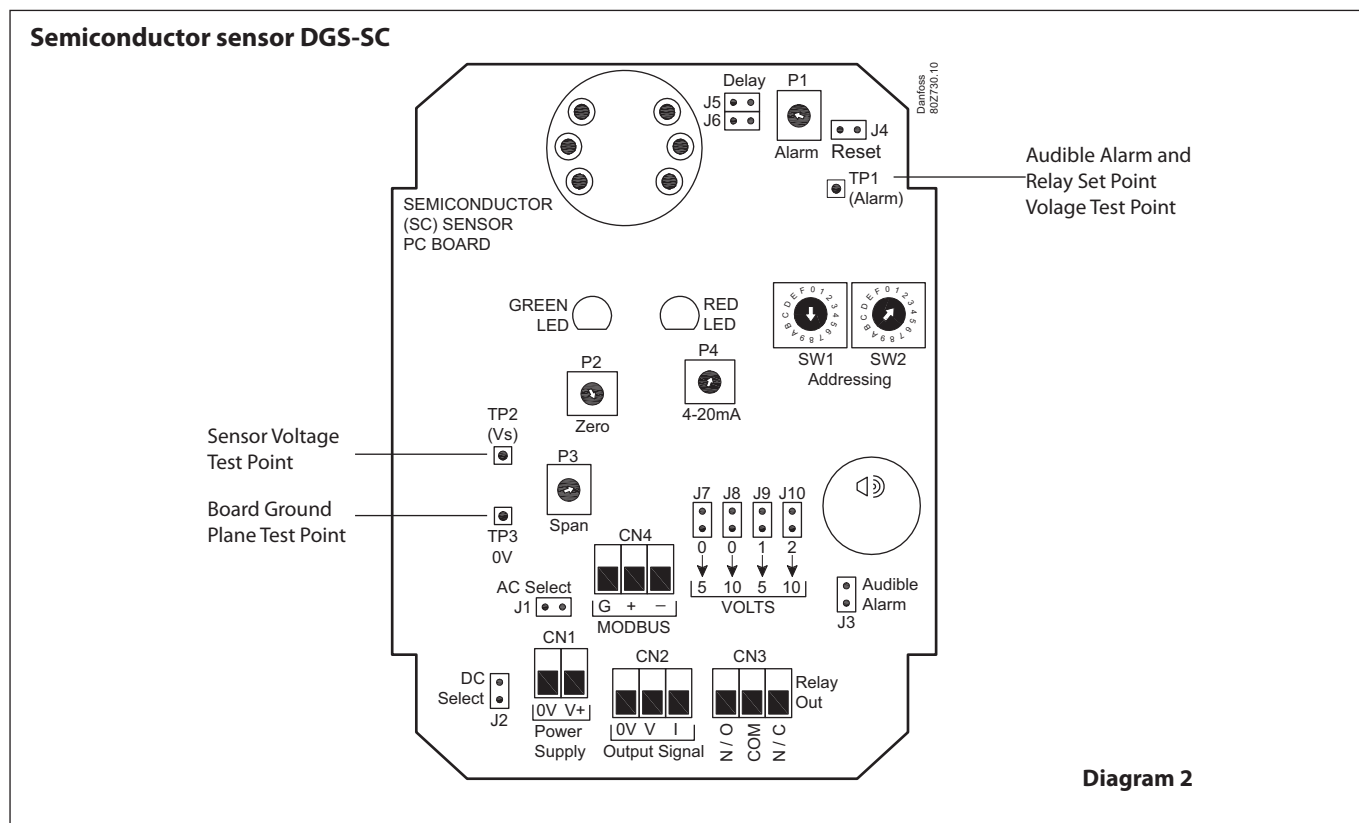
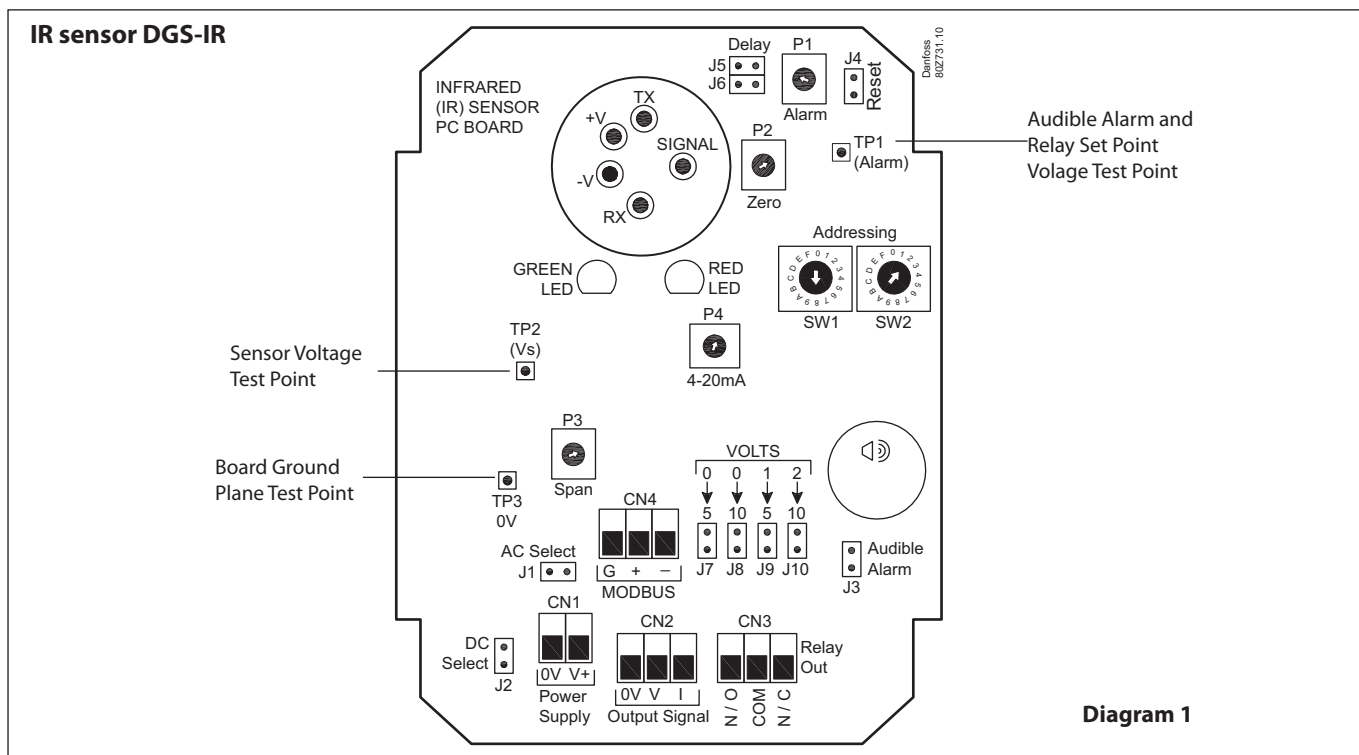
Baud rate

To choose a Baud rate, set the address as shown below 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 and temporarily shorting jumper J4 (or by cycling the power off and on)

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

For more information about data communication see document RC8AC--

DGS -Installation and wiring diagram



DGS -Operating instructions

- 1- 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.
- 2- 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 voltage or current output changes proportional to gas concentration
- 3- Fault condition: (e.g. sensing error)
 - the green LED will be off
 - the red LED will be on
 - 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
- 4- Manual control

It is possible to perform a manually control to verify the buzzer, LED's and alarm relay, see Menu Survey.

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 immediately after installation.

DGS - Bump Test Instructions

Expose the sensors to test gas using a Danfoss ampoule (CO₂) or test cylinder (appropriate to the installation). The gas is heavier than air and should fall into the DGS. This will put the system into alarm. The red LED will light showing the system is in alarm. The delay will prevent the buzzer sounding or relay switching for the preset delay, if delay is set.

With a bump test you can see the functions of the sensor - the red led will light, the relay and buzzer will function, the output selected, say 0-10V- will show the gas level.

To test the buzzer and or relay function, check the delay is set at zero using the header as shown on the installation diagram and expose to gas as above. You can mute the buzzer by removing the jumper J2.

After the gas has cleared the red led, buzzer and relay will automatically reset.

Before testing the sensors on site the DGS must have been powered up and allowed to stabilize.

DGS Sensor - Annual Test

To comply with the requirements of EN378 and the F GAS regulation sensors must be tested annually. However local regulations may specify the nature and frequency of this test. If not the Danfoss recommended procedure should be followed. See the installation and operation guide for details.



Check local regulations on calibration or testing requirements.

After exposure to a substantial gas leak, sensor should be checked and replaced if necessary.

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) 0 = No active alarm(s) 1 = Alarm(s) active	0	1	0	-	GD alarm
Common indication of both alarms incl. warnings 0 = No active alarm(s) or warning(s) 1 = Alarm(s) or warning(s) active	0	1	0	-	Common errors
Alarm limit in % if set to 0 hardware potentiometer configuration is used (hardware configured limit will be shown).	0.0	100.0	0.0	%	Alarm limit %
Alarm limit in ppm if set to 0 hardware potentiometer configuration is used (hardware configured limit will be shown).	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).	0	10	0	min.	Alarm delay
When set to 1, the alarm relay and buzzer 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. OBS: The alarm condition is not reset only the buzzer and relay indications are reset. Used to mute an external alert (audible/visible) 0 = Alarm outputs not muted 1 = Alarm outputs muted	0	1	0	-	Reset alarm
Maximum duration of alarm reset before automatic re-enable of external indicators (mute time out 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
Service					
Read out of refrigerant (Gas) for the DGS is used for 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 0 = Ready 1 = Warming Up	0	1	0	-	Startup flag
When cleared, clears calibration due alarm and resets the burning hours parameter 0 = Calibration valid 1 = Calibration due	0	1	0	-	Reset cal
Failsafe operation of the Relay 0 = Not failsafe 1 = Failsafe	0	1	0	-	Relay failsafe
Enables Manual control of Relays, buzzer and LED's. Automatically falls back to Off after 10 min.	0	1	0	-	Manual Control
Status of the alarm relay 0 = No alarm signal 1 = alarm signal	0	1	0	-	Alarm Relay
Status of the buzzer 0 = inactive 1 = active	0	1	0	-	Buzzer
Status of the red LED 0 = off 1 = on	0	1	0	-	Red LED

Status of the green LED 0 = off 1 = on	0	1	0	-	Green LED
Alarms					
Limit alarm 0 = Alarm not active 1 = Alarm, gas limit exceeded	0	1	0	-	Limit alarm
0 = OK 1 = Fault. Out of range under test	0	1	0	-	Sensor saturated
0 = OK, sensor in place 1 = Fault, Sensor out or removed	0	1	0	-	Sensor out
0 = OP, Sensor not due for calibration 1 = Warning, Due for calibration	0	1	0	-	Calibrate sensor
0 = OK, Gas level below warning level 1 = Warning, Gas level above warning level and delay expired	0	1	0	-	Warning limit al.

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

DGS - Troubleshooting

Symptom	Possible Cause(s)
Green and Red light off	<ul style="list-style-type: none"> • Check power supply. Check wiring. • 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)	<ul style="list-style-type: none"> • Sensor may be disconnected from printed circuit board. Check to see sensor is properly inserted into board. • The sensor has been damaged or has reached the end of life and needs to be exchanged. Contact Danfoss for instructions and support • The zero-adjustment has been reduced to achieve a zero-measurement in an environment with gas, typically CO₂. Do a zero-adjustment with a zero-gas and a re-calibration.

Alarms in the absence of a leak	<ul style="list-style-type: none"> • If you experience alarms in the absence of a leak, try setting an alarm delay. • 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).

*Technician use only

This unit must be installed by a suitably qualified technician who will install this unit in accordance with these instructions and the standards set down in their particular industry/country. Suitably qualified operators of the unit should be aware of the regulations and standards set down by their industry/country for the operation of this unit. These notes are only intended as a guide and the manufacturer bears no responsibility for the installation or operation of this unit. Failure to install and operate the unit in accordance with these instructions and with industry guidelines may cause serious injury including death and the manufacturer will not be held responsible in this regard.

