**Data Sheet**

# Gas detection unit
# **Heavy duty**

Type **GD Heavy Duty**
Next generation gas detection for industrial refrigeration

The Heavy Duty gas detection units are used for monitoring and warning of hazardous Ammonia gas concentrations. They are intended for ATEX/ IECEx applications and consists of a robust flameproof metal enclosure that can be kept closed after wiring, since programming (configuration) is performed by magnetic field to the display via a magnetic pen.Depending on the application, they are available with an electrochemical, a semiconductor or a Pellistor sensor covering a wide range of ppm.

The Heavy Duty gas detection units are intended as Stand-alone, or connected to a central system like Gas Detection Controller Unit, or a PLC.

As stand-alone the on-board relay can be used for activation of alarm devices, while the Analog or RS485 Modbus connection to a central system allows additional centralized monitoring and alarm activation.

The gas detection units come with a factory default, 2-step alarm set-up ready for use. The integrated software enables the user to configure two individual alarm ranges. Alarm 1, a pre-alarm indicating the gas level has passed a predefined threshold 1, and - if the gas level passes predefined threshold 2 - the final alarm 2.

## Features

- Digital, factory configured and pre-calibrated gas detectors for plug-and-play installation (no adjustment required)
- Easy configuration via Display and Magnetic pen and intuitive user-interface; helps simplify operator handling and minimize risk of operational, settings and calibration errors
- Stand-alone (integrated relay) and/or flexible connection to central controller - by either Analog or RS485 open Modbus communications
- Wide selection of sensor types and detection ranges
- Display background color indicating alarm or communication fault by turning red
- Fieldbus wiring - connect and power up to 96 sensors, wire length max. 900 meters (2953 ft) per segment; controller expansion modules permits additional segments and alarm relays
- Automatic self-diagnostics to ensure correct communication and operation. On board fault relay
- Sensor seal cap to prevent premature exposure during installation
- Digital user interface ensures high sensor accuracy
- Reduced risk of false alarms due to temperature compensated sensors
- Password protected alarm settings allowing authorized access only
- LCD display with status LED
- Magnetic pen/On-board acknowledge button to reset alarms and to verify that no gas leaks are present
- Service alerts on unit, controller or both, readable via service tool Display
- Quick and precise calibration procedures - either by Plug & Play replacement sensors or calibration with gas
- No potentiometers or multi-meters required
- For improved safety and to optimize the lifetime of the sensor, degenerated sensors with too low sensitivity (<30%) are rejected during calibration process
- Conformity to Ex d EN60079-0, -1, Ex d IEC 60079-0, -1, EN 50402, EN 61508-1, -2, -3, EN 50271
- Certificate BVS 18 ATEX E 052 X, IECEx BVS 18.0044X
- Enables regulatory compliance with EN 378:2016, ISO 5149:2014, IIAR 2-2017, and ASHRAE 15:2016

# Functions

**Working principle/Operation**
One sensor is connected to the Heavy Duty sensor board via local bus. The Sensor board provides the power supply of the sensor and prepares the measured data for digital communication.

The operation menu of the Heavy Duty software is accessed through the Display via a Magnetic pen, or the connected Gas Detection Controller, or via the dedicated GD Service tool (or PC tool). The Service tool (or PC tool) is plugged directly to the board of the unit by use of an adapter. These interfaces allow the unit configuration, setting of the unit alarm levels and calibration of the attached sensor.

The service tool (or PC tool) can be used on all units across the Basic, Premium and Heavy Duty platforms.

For Stand-alone units the alarm signals are handled by the unit software, which activates the integrated relay directly. For central controlled units the alarm signals are handled by the Gas Detection Controller (or a PLC) via the 4-20 mA (2-10V) analog output or the RS485 open Modbus communication.

For additional operational safety the changing of parameters is password protected allowing authorized access only. The factory default password can easily be customized.
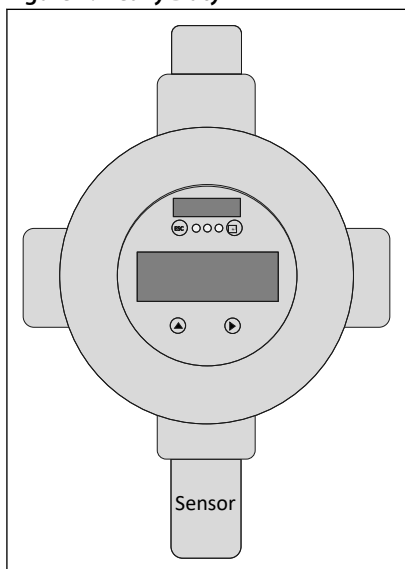
## Product specification

### Design

### General info

- Cable gland mounted
- Sensor head (SX1) mounted bottom

**Figure 1: Heavy Duty**



### Gas types and thresholds

**Table 1: Gas types and thresholds**

| Sensor | Sensor Type | ppm range | Alarm 1(Alarm relay) | Alarm 2 | Hysteresis |
|---|---|---|---|---|---|
| **Ammonia EC 100** | Electrochemical | 0 – 100 | 25 ppm | 35 ppm | 2 ppm |
| **Ammonia EC 300** | Electrochemical | 0 – 300 | 25 ppm | 150 ppm | 2 ppm |
| **Ammonia EC 1000** | Electrochemical | 0 – 1000 | 500 ppm | 900 ppm | 25 ppm |
| **Ammonia EC 5000** | Electrochemical | 0 – 5000 | 1000 ppm | 4500 ppm | 50 ppm |
| **Ammonia SC 10000** | Semiconductor | 0 – 10000 | 5000 ppm | 9000 ppm | 250 ppm |
| **Ammonia P LEL** | Pellistor | 0 – 140000 (0 – 100% LEL) | 21% LEL (30000 ppm) | 21% LEL (30000 ppm) | 1% LEL |
| **HC R290/Propane P 5000** | Pellistor | 0 – 5000 | 800 ppm | 2500 ppm | 40 ppm |

ⓘ **NOTE:**

Hysteresis = 5% of Alarm1 (rounded up to the next higher integer)
Alarm thresholds must be set within 10 to 90% of the sensor range.

### Electrical

**Table 2: Electrical**

| Details | Description |
|---|---|
| **Power supply** | 20 – 28 V DC |
| **Power consumption (24 V DC)** | 90 mA, max. 130 mA |
| **Control unit** | Microprocessor with 12 bit converter resolution |
| **Digital filter** | Averaging in order to increase the EMC immunity |
| **Visual indications** | 2 LEDs for operation, alarm and communication |

| Details | Description |
|---|---|
| Analog output signal (active) | Proportional, overload and short-circuit proof, load ≤ 500 Ω |
| | 4 – 20 mA = measuring range |
| | 3.0 < 4 mA = underrange |
| | > 20 – 21.2 mA = overrange |
| | 2 mA = fault |
| | > 21.8 mA = fault High |
| Serial interface | Serial data bus |
| Fault relay | Max. 30 V AC/DC, 1 A |
| Alarm relay | Max. 30 V AC/DC, 1 A |
| LCD | 2 x 16 characters, 3 status LEDs, 4 menu operating elements |

## Sensor data

Table 3: Sensor data

| Details | Description | | |
|---|---|---|---|
| Gas type | Flammable gases | Toxic gases | HCFC, HFC, HFO |
| Sensor element | Pellistor | Electro Chemical | Semiconductor |
| Measuring range | 0 – 100 % LEL | 0 – 1000 ppm / 0 – 5000 ppm | 0 – 10000 ppm |
| Response time | $t_{90}$ < 20 sec. $NH_3$ | $t_{90}$ < 40 sec. for $NH_3$ | $t_{90}$ > 120 sec. for $NH_3$ |

## Sensor head housing

Table 4: Sensor head housing

| Details | Description |
|---|---|
| Material | CrNi Stahl: 1.4404 |
| Dimensions (d x H) | 30 x 56 mm (1.18 x 2.20 in.) |
| Protection class | Gas inlet IP64, with option splash-proof IP65 |
| Thread | External thread M30 x 1.5 |

## Environmental conditions

Table 5: Environmental conditions

| Details | Description |
|---|---|
| Humidity | 15 to 90% r.H. |
| Operating temperature | **P:** -40 ℃ to +60 ℃ / EC: -40 ℃ to +50 ℃ / SC: -40 ℃ to +50 ℃ |

## Physical characteristics

Table 6: Physical characteristics

| Details | Description |
|---|---|
| Case / colour | Aluminium pressure die-casting / light grey RAL 7032, epoxy coating |
| Dimensions (d x H) | 95 x 82 mm |
| Weight | Ca. 1.3 kg |
| Protection class | Housing protection IP66 to IP68 (depending on the cable glands used) |
| Mounting | Wall mounting (sensor head downwards) |
| Cable entry | 1 x ⁄ in. (Ansi B1.20.1) |
| Wire connection | Spring-type terminal, 0.08 to 2.5 mm² AWG 28 - 12 |
| Wire length | Max. load 500 Ω (= wire resistance + controller input resistance) |

## ATEX marking

Table 7: ATEX marking

| | |
|---|---|
| ⟨Ex⟩ | II 2G Ex db IIC T4 Gb CE 0539 |

## LCD display

**Table 8: LCD display Options**

| Details | Description |
|---|---|
| LCD | Two lines, 16 characters each, background highlighted in two colours |
| Operation | Menu driven via four magnetic buttons |
| Power consumption | 5 V, 60 mA, 0.3 VA |

## Status LED

**Table 9: Status LED**

| Details | Description |
|---|---|
| Colour / Mode | Red / yellow / green (alarm – fault – operation - service) |
| Protection class | IP65 |

## Service and maintenance

The Heavy Duty gas detection units are calibrated either by replacing of sensor heads or by calibration with gas.

Plug & Play replacement sensors are pre-calibrated and factory certified for quick and easy calibration procedure. The sensor is connected to the local bus via a plug connection enabling easy and simple exchange of sensor instead of a calibration. The internal X-change routine recognizes the exchanged sensor during the exchange process and restarts the measurement mode automatically. An LED indicates the correct procedure of the exchange operation.

To ensure the proper functioning of the units and to prevent human errors, the sensor head can only be replaced by the same type and ppm range (exact replacement) that match the configuration. If a different sensor head is installed, the GD unit will show a communication error.

As an alternative, calibration with gas can be performed via the service tool (or PC tool), calibration gas with correct concentration and the Danfoss calibration adapter. The Danfoss gas detection units have an integrated, digital calibration interface and procedure, which makes the calibration process easy, accurate, and time-saving. No potentiometers or multi-meters required for the calibration. The calibration procedure requires significantly less calibration gas per calibration compared to traditional routines.

## Electrical connection

**Figure 2: Electrical connection**
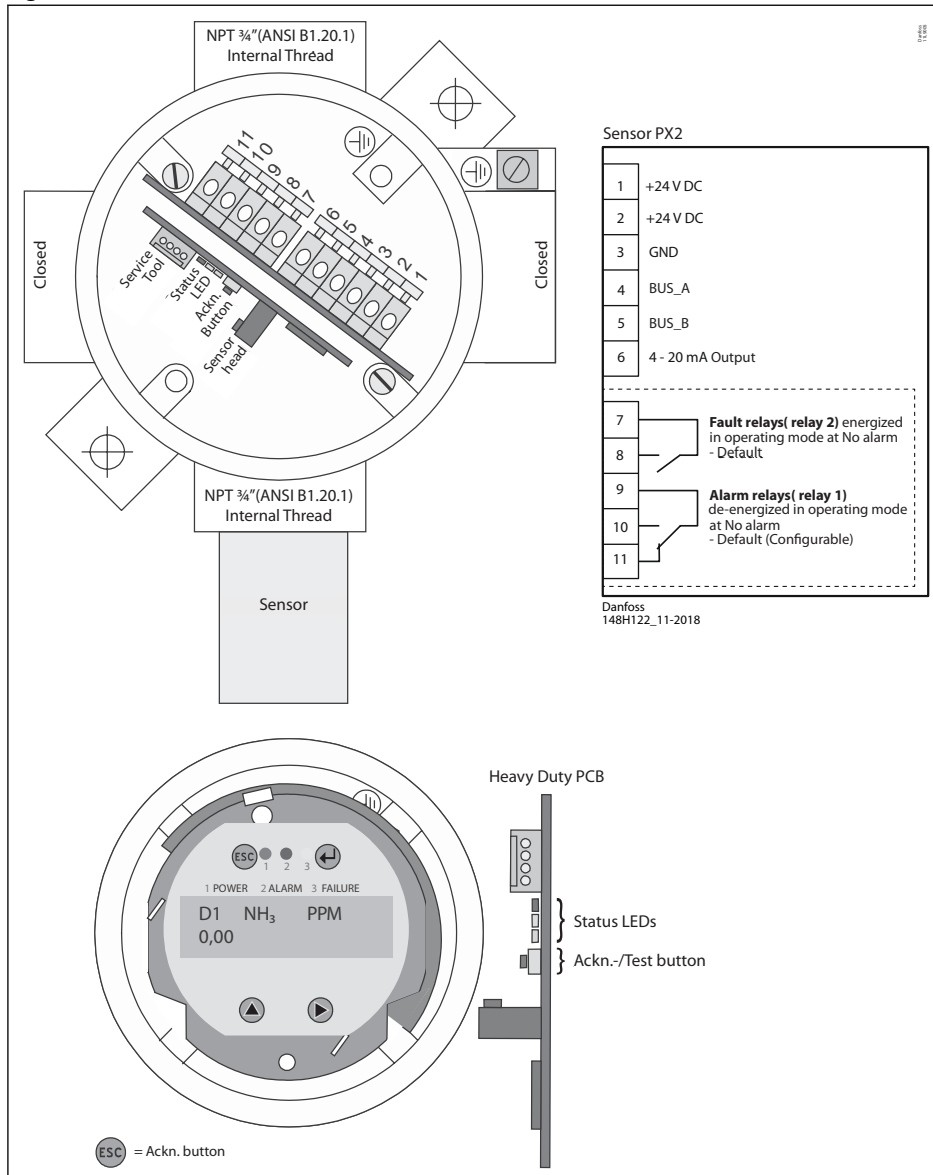


**On board LED is similar to the display LED:**
- Green (1) is power on
- Yellow (2) is an indicator of Error.
  - when the sensor head is disconnected or not the expected type
  - AO is activated but nothing connected
- Red (3)
  - on alarm

**On board Ackn. -/Test button:**
- Test:
  - The button must be pressed for 20 sec.
  - Alarm is simulated, stop on release

- Ackn.:
  - Pressed while Alarm2, the audible warning switches off and goes back on after 5 min. when the alarm situation is still active (also possible over ESC button (use the magnetic pen).

## Fieldbus loop

Each GD controller can handle up to 96 sensors and handle any mix of individual Gas detection units of the types Basic, Premium and Heavy Duty.

The max. recommended loop wire length is 900 meter (2953 ft) per segment.

With additional segments (and additional controller expansion modules) the max recommended loop wire length is 7200 meter (23622 ft).

The controller and the last GDU in each segment must be provided with a resistor of 560 Ohm. A Umin of 16 V DC must be secured at any spot in the loop.

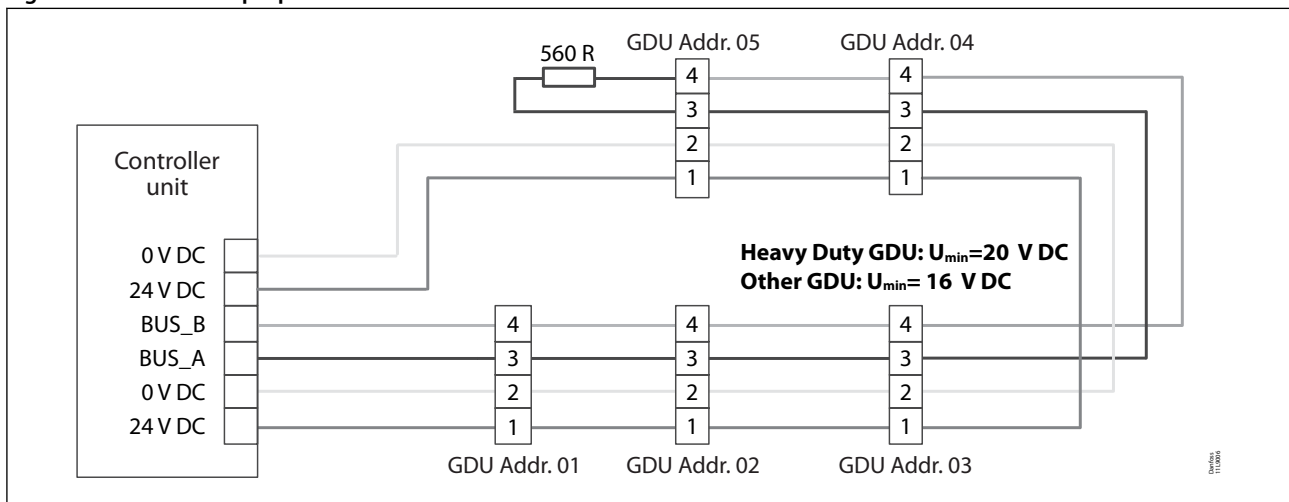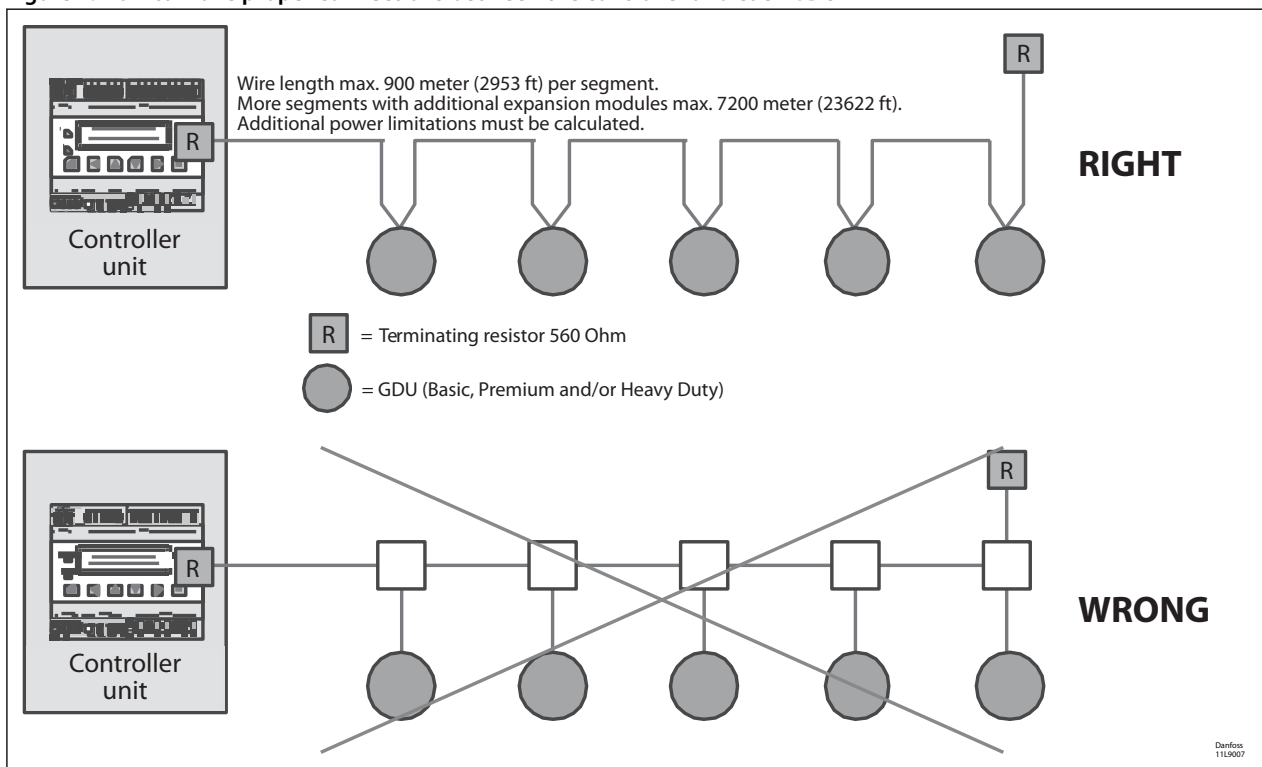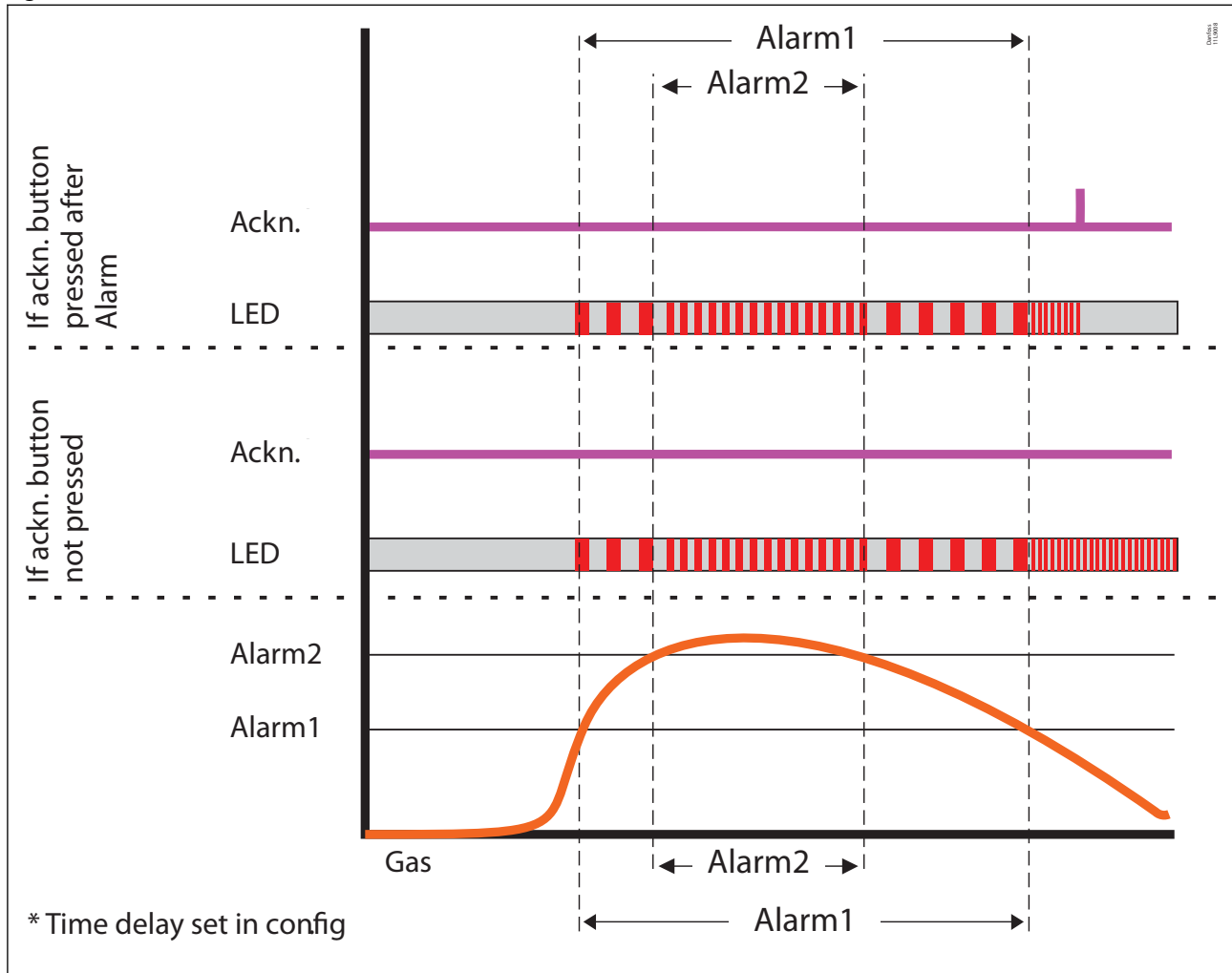**Figure 3: How to make proper connections between the controller and each GDU**



**Figure 4: How to make proper connections between the controller and each GDU**

## Alarm scheme

**Figure 5: Status LED**



| | | |
|---|---|---|
| ▮▮▮ | | Blinking (2 sec.) |
| ▮▮▮▮▮ | | Fast blinking (1 sec.) |
| ▮▮▮▮▮▮ | | Very fast blinking (0.1 sec.) |
| ▮ | | Power LED |
| ▮ | | Failure (e.g. sensor head is disconnected) |
| ▮▮▮▮ | | Slow blinking, sensor warm up |
| ▮▮▮▮▮ | | Fast blinking, sensor is in special mode (e.g. to change parameters, ...) |

## Ordering

**Table 10: Ordering**

| Type | Model | Display included | Refrigerant | Sensor | ppm (range) | Alarm ppm | Temp range (°C) | Temp range (°F) | Code number |
|------|-------|------------------|-------------|--------|-------------|-----------|-----------------|-----------------|-------------|
| GDA | Heavy Duty | Yes | Ammonia | Electrochemical | 0 – 100 | 25/35 | -20 to +50 | -4 to +122 | **148H6059** |
| | Heavy Duty | Yes | Ammonia | Electrochemical | 0 – 300 | 25/150 | -20 to +50 | -4 to +122 | **148H6060** |
| | Heavy Duty | Yes | Ammonia | Electrochemical | 0 – 1000 | 500/900 | -20 to +50 | -4 to +122 | **148H6022** |
| | Heavy Duty | Yes | Ammonia | Electrochemical | 0 – 5000 | 1000/4500 | -20 to +50 | -4 to +122 | **148H6031** |
| | Heavy Duty | Yes | Ammonia | Semiconductor | 0 – 10000 | 5000/9000 | -20 to +50 | -4 to +122 | **148H6035** |
| | Heavy Duty | Yes | Ammonia | Pellistor | 0 – 140000 (0 – 100% LEL) | 30000 (21% LEL) | -20 to +60 | -4 to +140 | **148H6039** |
| | Heavy Duty | No | Ammonia | Electrochemical | 0 – 100 | 25/35 | -40 to +50 | -40 to +122 | **148H6064** |
| | Heavy Duty | No | Ammonia | Electrochemical | 0 – 300 | 25/150 | -40 to +50 | -40 to +122 | **148H6065** |
| | Heavy Duty | No | Ammonia | Electrochemical | 0 – 1000 | 500/900 | -40 to +50 | -40 to +122 | **148H6066** |
| | Heavy Duty | No | Ammonia | Electrochemical | 0 – 5000 | 1000/4500 | -40 to +50 | -40 to +122 | **148H6067** |
| | Heavy Duty | No | Ammonia | Semiconductor | 0 – 10000 | 5000/9000 | -40 to +50 | -40 to +122 | **148H6068** |
| | Heavy Duty | No | Ammonia | Pellistor | 0 – 140000 (0 – 100% LEL) | 30000 (21% LEL) | -40 to +60 | -40 to +140 | **148H6069** |
| GDH | Heavy Duty | Yes | R290 (R1270, R600A) | Pellistor | 0 – 5000 | 800/2500 | -20 to +60 | -4 to +140 | **148H6061** |

## Spare parts and accessories

**Table 11: Spare parts and accessories**

| Description | Code number |
|-------------|-------------|
| Replacement sensor - Heavy Duty Ammonia EC 100 | **148H6240** |
| Replacement sensor - Heavy Duty Ammonia EC 300 | **148H6241** |
| Replacement sensor - Heavy Duty Ammonia EC 1000 | **148H6217** |
| Replacement sensor - Heavy Duty Ammonia EC 5000 | **148H6218** |
| Replacement sensor - Heavy Duty Ammonia SC 10000 | **148H6219** |
| Replacement sensor - Heavy Duty Ammonia P LEL | **148H6220** |
| Replacement sensor - Heavy Duty R290 / Propane P 5000 | **148H6242** |
| Controller unit | **148H6231** |
| Controller solution (controller + enclosure) | **148H6221** |
| Controller solution Uptime | **148H6237** |
| Controller expansion module | **148H6222** |
| Service tool | **148H6224** |
| PC Tool | **148H6235** |
| Calibration adapter Heavy duty | **148H6233** |
| Gateway for controller | **148H6228** |
| Magnetic pen | **148H6229** |

## Accessories overview

### Controller unit
Used for a centralized monitoring and warning. The input signals for the controller are collected via RS485 Modbus or analog communication. The controller can handle up to 96 digital sensors via Fieldbus and four (4) analog input. An additional 28 analog input is possible using seven (7) expansion modules (4-20 mA signal interface). The total number of connected sensors should not exceed 128 sensors. The controller unit can be employed as pure analog controller, as analog/digital, or as digital controller. Configuration is menu-driven via the keypad. For fast and easy configuration, the PC Tool is recommended.

### Controller solution
Controller unit placed in an enclosure ready to be connected to a power source. A separate UPS for the controller is available.

### Controller expansion module

The gas detection Controller Expansion module is used for expansion of the cable coverage in terms of number of loops and the total wire length. Each Controller Unit can handle up to 7 Expansion modules allowing additional 7 segments with a total of 7200 meters (23622 ft.) wiring and a total of 32 relays for alarm device circuits.

### Service tool
For interface with units with no display (Basic, Basic+, Premium, Premium+). Acts as a portable display and can be connected to all Danfoss gas detection units. (Heavy Duty w. adapter).

### PC tool
The PC tool is a menu-driven and standalone software used for easy addressing, parameter setting, calibration, and data logging of the Basic, Premium and Heavy Duty gas detection units, and the controller unit.

### Calibration adapter
The calibration adapter is required for connecting the calibration gas container, via the flow regulator, to the sensor head on the gas detection units. (Two variants, One for Basic and Premium plastic head sensors; one for heavy duty and Premium remote metal head sensors.).

### Gateway for controller
The gateway is an addition to the controller and used for communicating via Modbus TCP/IP.

### Magnetic pen
The pen is used to operate the Heavy Duty unit display. The Heavy Duty enclosure does not permit direct touch.

## Certificates, declarations, and approvals

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**Table 12: Valid Approvals**

| File name | Document type | Document topic | Approval authority |
| --- | --- | --- | --- |
| DEKRA BVS 18 ATEX E 052 X | Explosive - Safety Certificate | ATEX | |
| DEKRA IECEx BVS 18.0044X | Explosive - Safety Certificate | IECEx | |
| 500000219230.AA | Manufacturers Declaration | Similarity | Danfoss |
| 148R6115.AA | EU Declaration | EMCD/LVD | Danfoss |
| Intertek 4000518 | | ETL | |

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