

## Product Specification

# Senseair Refrigerant Detection System

Refrigerant Leakage Sensor for R32, R454A, R454B and R454C



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## General

Item	Senseair RDS R32, R454A, R454B and R454C
Operating principle	Non-dispersive infrared (NDIR)
Measured gas	R32, R454A, R454B and R454C <sup>1</sup>
Measurement range	0–50% LFL <sup>2</sup>
Accuracy	Standard range: $\pm 2.5\%$ LFL <sup>2, 3, 4</sup> Extended range: $\pm 5\%$ LFL <sup>2, 3, 4</sup>
Resolution	0.007% LFL (10 ppm)
Operating conditions	-40–70 °C, < 95% RH <sup>2</sup>
Warm-up time	0 s
Response time	< 30 s <sup>5</sup>
Power supply options	24 $\pm 10\%$ VAC/DC (009-3-0007 Senseair RDS R32 24V) 12 $\pm 10\%$ VDC (009-3-0008 Senseair RDS R32 12V) 5 $\pm 10\%$ VDC (009-3-0009 Senseair RDS R32 5V) <sup>6</sup>
Average current consumption Heaters Off	11 mA / 0.27 W (009-3-0007 Senseair RDS R32 24V) 13 mA / 0.16 W (009-3-0008 Senseair RDS R32 12V) 4 mA / 0.2 W (009-3-0009 Senseair RDS R32 5V)
Average current consumption Heaters On, Max Power	75 mA / 1.8 W (009-3-0007 Senseair RDS R32 24V) 150 mA / 1.8 W (009-3-0008 Senseair RDS R32 12V) 300 mA / 1.5 W (009-3-0009 Senseair RDS R32 5V)
Output	Digital signal (High/Low or PWM) or Analogue voltage <sup>7</sup> or Analogue current. <sup>8</sup> Digital High/Low is default factory setting. <sup>5</sup>
Connector	8-pin (mates with Amphenol MicroSpaceXS™ 10155470-A008LF)
Compliance	IEC 60335-2-40 Ed.7, UL 60335-2-40 Ed.4
Enclosure	Injection moulded plastic, UL94V-0 rated
Communication	Modbus over RS-485 <sup>6, 9</sup>
Pressure dependence	1% reading per kPa deviation from normal pressure
Maintenance	Maintenance free with Senseair ABC
Life expectancy	> 15 years
Dimensions	113 x 65 x 40 mm
IP Rating	IP66 & IP67
Weight	< 65 g
Storage conditions	-40–85 °C

Table 1 General specifications

- Note 1: Sensor measures molecules containing C-H bonds
- Note 2: Standard range: 0–25% LFL and -30–60 °C  
Extended range: 25–50% LFL and -40–70 °C
- Note 3: After 3 ABC periods or 1 zero calibration and default measurements settings
- Note 4: Specification is referenced to uncertainty of calibration gas mixtures ( $\pm 1\%$ )
- Note 5: When exposed to R32 with concentration 25% LFL or higher, and Detection Threshold Limit Value set to 10% of LFL (default factory setting)
- Note 6: 009-3-0009 Senseair RDS R32 5V is hardware configured for UART communication and digital output (no RS-485 or analogue outputs are available on this variant)
- Note 7: Analogue voltage output adds an additional uncertainty of  $\pm 30$  mV
- Note 8: Analogue current output adds an additional uncertainty of  $\pm 0.5$  mA
- Note 9: Configurable baud rate, range 9600 to 115.200 bps

## Description

Senseair Refrigerant Detection System R32 is a leak detection sensor module for HVAC applications using the mildly flammable, low GWP, A2L refrigerant R32. A protective housing, with a high-quality gas diffusion vent, protects the sensor element from dust and condense water droplets. Thanks to the built-in heating element, the Senseair RDS can operate in cold environments.

Using Modbus protocol, the measured data can digitally be transmitted to the control system. A digital output signal is activated whenever the measured gas concentration reaches a configurable threshold. The output can alternatively be configured as a digital PWM signal or an analogue linear output reflecting the measured gas concentration.

## Applications

Senseair RDS R32 is intended for mounting inside or close to the HVAC appliance, where a leak could potentially occur.

### Sensor key benefits:

- Fast response time
- High accuracy
- Wide temperature range
- Maintenance-free
- Compliant with IEC / UL 60335-2-40
- Factory calibrated
- Long term stability
- Long lifetime
- Immune to poisoning
- Based on LED light source

## Installation and connector pinout

Refer to Installation manual Senseair Refrigerant Detection System (IMA14493).

## Absolute Maximum Ratings

Over operating temperature range (unless otherwise noted); all voltages are with respect to GND <sup>(1)</sup>

Symbol	Description	Min	Max	Unit
V <sub>BB</sub>	Supply voltage (009-3-0007 Senseair RDS R32 24V)	-0.3	37	V
	Supply voltage (009-3-0008 Senseair RDS R32 12V)	-0.3	13.2	V
	Supply voltage (009-3-0009 Senseair RDS R32 5V)	-0.3	5.5	V
V <sub>I,A</sub>	RS-485 A input voltage*	-9	13	V
V <sub>I,B</sub>	RS-485 B input voltage*	-9	13	V
I <sub>O,TX</sub>	TX output current		±50	mA
V <sub>I,RX</sub>	RX input voltage	-0.3	5.5	V
I <sub>O,OUT1</sub>	OUT1 output current		±50	mA
I <sub>O,OUT2</sub>	OUT2 output current		±50	mA
I <sub>O,OUT3</sub>	OUT3 output current		±50	mA

Table 2 Absolute Maximum Ratings

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

## Recommended Operating Conditions

Over operating temperature range (unless otherwise noted) <sup>(2)</sup>

Symbol	Description	Min	Typ	Max	Unit
V <sub>BB</sub>	Supply voltage (009-3-0007 Senseair RDS R32 24V)	21.6	24	26.4	VAC/VDC
	Supply voltage (009-3-0008 Senseair RDS R32 12V)	10.8	12	13.2	VDC
	Supply voltage (009-3-0009 Senseair RDS R32 5V)	4.5	5	5.5	VDC
V <sub>I,A</sub>	RS-485 A input voltage*	-7		12	V
V <sub>I,B</sub>	RS-485 B input voltage*	-7		12	V
I <sub>OH,TX</sub>	TX high level output current			-24	mA
I <sub>OL,TX</sub>	TX low level output current			24	mA
V <sub>I,RX</sub>	RX input voltage	0		5.5	V
I <sub>OH,OUT1</sub>	OUT1 high level output current (009-3-0007 Senseair RDS R32 24V) (009-3-0008 Senseair RDS R32 12V)			-32	mA
	OUT1 high level output current (009-3-0009 Senseair RDS R32 5V)			-24	mA
I <sub>OL,OUT1</sub>	OUT1 low level output current (009-3-0007 Senseair RDS R32 24V) (009-3-0008 Senseair RDS R32 12V)			32	mA
	OUT1 low level output current (009-3-0009 Senseair RDS R32 5V)			24	mA
I <sub>O,OUT2</sub>	OUT2 output current			±25	mA
R <sub>L,OUT3</sub>	OUT3 load resistance (009-3-0007 Senseair RDS R32 24V)			400	Ω
	OUT3 load resistance (009-3-0008 Senseair RDS R32 12V)			300	Ω

Table 3 Recommended Operating Conditions

Note 2: Limited to the value specified.

\* 009-3-0009 Senseair RDS R32 5V is limited to UART communication and digital output (no RS-485 and analogue outputs are available)

## Electrical Characteristics

Over operating temperature range.

$V_{BB} = 24VAC$  for 009-3-0007, 12VDC for 009-3-0008, 5VDC for 009-3-0009 unless otherwise noted.

Symbol	Description		Min	Typ	Max	Unit
	<b>Voltage</b>					
$V_{OUT1,OH}$	OUT1 output high voltage (009-3-0007 Senseair RDS R32 24V) (009-3-0008 Senseair RDS R32 12V)	$I_{OH} = -32 \text{ mA}$	3.3		5.5	V
	OUT1 output high voltage (009-3-0009 Senseair RDS R32 5V)	$I_{OH} = -24 \text{ mA}$	2		3.6	V
$V_{OUT1,OL}$	OUT1 output low voltage (009-3-0007 Senseair RDS R32 24V) (009-3-0008 Senseair RDS R32 12V)	$I_{OL} = 32 \text{ mA}$	0		0.7	V
	OUT1 output low voltage (009-3-0009 Senseair RDS R32 5V)	$I_{OL} = 24 \text{ mA}$	0		0.7	V
$V_{OD}$	RS-485 differential output voltage	$R_L = 54 \Omega$	1.5		5.5	V
$\Delta V_{OD}$	RS-485 change in magnitude of differential output voltage	$R_L = 54 \Omega \text{ or } 100 \Omega$			0.2	V
$V_{OC}$	RS-485 common-mode output voltage	$R_L = 54 \Omega \text{ or } 100 \Omega$			3	V
$\Delta V_{OC}$	RS-485 change in magnitude of common-mode output voltage	$R_L = 54 \Omega \text{ or } 100 \Omega$			0.2	V
$V_{TH}$	RS-485 differential input threshold voltage		-0.2		0.2	V
$\Delta V_{HYS}$	RS-485 differential input hysteresis	$T_A = 25 \text{ }^\circ\text{C}$		28		mV
$V_{TX,OH}$	TX output high voltage	$I_{OH} = -24 \text{ mA}$	2		3.6	V
$V_{TX,OL}$	TX output low voltage	$I_{OH} = 24 \text{ mA}$	0		0.7	V
$V_{RX,IH}$	RX input high voltage		2.5			V
$V_{RX,IL}$	RX input low voltage		0		0.55	V
$V_{OUT2}$	OUT2 output voltage range (009-3-0007 Senseair RDS R32 24V)	No load	0		13.2	V
	OUT2 output voltage range (009-3-0008 Senseair RDS R32 12V)	No load	0		$V_{BB}$	V
$V_{OUT3}$	OUT3 output voltage range (009-3-0007 Senseair RDS R32 24V)	No load	0		13.2	V
	OUT3 output voltage range (009-3-0008 Senseair RDS R32 12V)	No load	0		$V_{BB}$	V
	<b>Current</b>					
$I_{VBB}$	Operating peak current  (009-3-0007 Senseair RDS R32 24V) (009-3-0008 Senseair RDS R32 12V) (009-3-0009 Senseair RDS R32 5V)	With heaters activated Only one output active				mA

Table 4 Electrical Characteristics, Typical values at  $T_A = 25 \text{ }^\circ\text{C}$ .

## Output configuration

The Senseair RDS R32 features software configurable outputs. The outputs have dedicated pins in the connector. Note that the OUT1, OUT2 and OUT3 outputs are not independent – connect only one of the output pins to external circuitry!

During device startup the outputs will be set to 0 for a few seconds until the first valid gas concentration measurement is performed.

OUT1 is a digital output High/Low or PWM signal (default configuration is digital High/Low)

OUT2 is analogue voltage output (requires OUT1 to be configured as PWM)

OUT3 is analogue current output (requires OUT1 to be configured as PWM)

OUT1 signal function:

The OUT1 output signal in High/Low mode indicates sensor state:

- High signal indicates sensor normal operation
- Low signal indicates measured gas concentration exceeding Detection Threshold Limit Value

The OUT1 output signal in PWM mode indicates measured gas concentration:

- 0–100% PWM duty cycle signal indicates measured gas concentration

The OUT1 PWM signal is used internally to generate the OUT2 analogue voltage and OUT3 analogue current. This means that to use OUT2 or OUT3 as analogue output proportional to measured gas concentration, OUT1 must be configured in PWM mode.

If OUT1 is configured in High/Low mode (default) then OUT2 and OUT3 will assume the max or min value corresponding to OUT1 state.

Warning: In case any internal error should be detected (ErrorStatus register  $\neq 0$ ), the outputs will be set to 0 to indicate a SYSTEM RESPONSE\*

If output configuration is modified from factory default, avoid any configuration that defines 0 V / 0 mA as normal state (no refrigerant leak detected) or use Modbus communication to read ErrorStatus register to ensure no internal error has occurred.

\* SYSTEM RESPONSE is defined and required by IEC / UL 60335-2-40

For more details, see also installation manual (IMA14493) and "Modbus on Senseair RDS" (TDE13072).

Contact Senseair for more information!

## Communication

Refer to "Modbus on Senseair RDS" (TDE13072).

Physical interface is RS-485 \*

Baud rate is configurable from 9600bps up to 115.200 bps, default configuration is 9600 bps.

\* 009-3-0009 Senseair RDS R32 5V is hardware configured for UART communication and digital output (no RS-485 and analogue outputs are available)

## Maintenance

Senseair RDS R32 has a built-in self-correcting ABC algorithm. ABC period is adjustable by host and comes default with ABC ON and an ABC period of 720 h.

Discuss your application with Senseair in order to get advice for a proper calibration strategy.



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