OEM REFRIGERANT GAS SENSORS
for
Leak Detection & Measurement

DETECTABLE Gases:

Sensor LS-1	R134a
Sensor LS-2	R22
Sensor LS-3	CO_2
Sensor LS-4	R134, R404 , R407, R410
Sensor LS-5	R134, R404 , R407, R410, R22
Sensor LS-6	R600 , R290 , CH_3OH , C_6H_6 , C_7H_8 , C_8H_{10} …….
Sensor LS-7	SF_6 , NH_3
Sensor LS-8	CH_4
Sensor LS-9	CH_2O

REFRIGERANT GAS LEAK DETECTION SPECIFICATIONS :

Smallest detectable Refrigerant leak rates	R 134a	0.3 (g/y)	LS-1
	R 22	0.5 (g/y)	LS-2
	R 404	0.2 (g/y)	LS-4
	R 407	0.6 (g/y)	LS-4
	R410	0.8 (g/y)	LS-4
	R600	0.6 (g/y)	LS-6
HIGH res. Measuring scale	0 -100 (g/y)	res. 0.1 g/y	
LOW res. Measuring scale	0 -10000 (g/y)	res. 10 g/y	
Response time	0.5-1.5 (sec)		(1)
Gas flow (typ.)	120 sccm		(2)
Power Supply	+15/-15/0 V - 200 mA		
digital I/O	RS232		(3)

(1) the sensor response time can be set on customer demand. A faster response time means a lower detector precision.
(2) Sensor parameters are factory set for this flow rate. Different settings available on demand.
(3) Baud-rate=9600 (it can be differently set on customer demand), Data bits=8, Parity=none, Stop bits=1.

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ENVIRONMENTAL GAS CONCENTRATION MEASUREMENTS:

Smallest detectable Concentration (Sniffer method)	CO_2		1.0	PPM	LS-3
	CH_4		5.0	PPM	LS-8
	SF_6		0.5	PPM	LS-7
Smallest detectable Concentration (Close Circuit)	CH_2O		0.02	PPM	LS-9
	CH_3OH		0.01	PPM	LS-6
	C_6H_6		0.02	PPM	LS-6
	C_7H_8		0.02	PPM	LS-6
	C_8H_{10}		0.02	PPM	LS-6
HIGH res. Measuring scale	0 -100 PPM res. 0.1 PPM or 0-1000 PPM res. 1 PPM				
LOW res. Measuring scale	0 -10000 PPM res. 10 PPM or 0 - 100000 PPM res. 100 PPM				
Response time	0.5-1.5 (sec)				(1)
Gas flow (typ.)	120 sccm				(2)
Power Supply	+15/-15/0 V - 200 mA				
digital I/O	RS232				(3)

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WARM-UP:

- The use of the warm-up resistor (typically 15V;150 mA supply) for two to five minutes brings the I.R. cell to an improved stability at normal environmental temperatures (20°C). The optimal warm-up time should be determined depending on the different gas detectors and environmental conditions.
- Precise measures are recommended after at least 30 minutes from the warm-up cycle.

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BOARD CONNECTIONS:
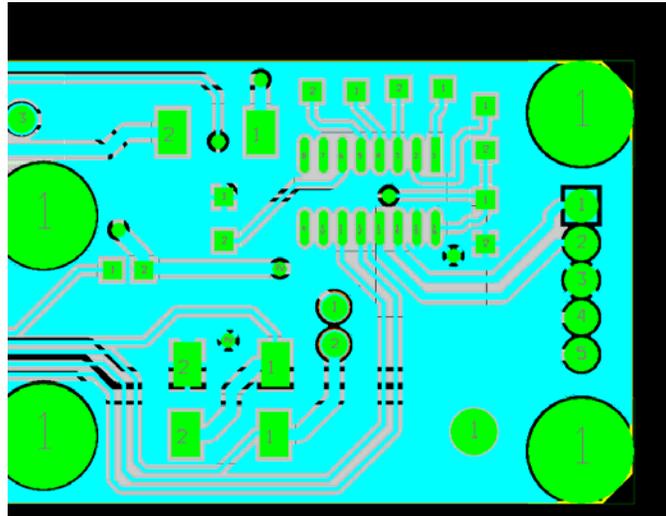
Sensor Board TOP View

Pin #1: RS232   tx from sensor board = rx from master PC   (pin 2 RS232 std. connector)
Pin #2: RS232   rx from sensor board = tx from master PC   (pin 3 RS232 std. connector)
Pin #3: GND   = P.S. ground and RS232 ground   (pin 5 RS232 std. connector)
Pin #4: P.S. +15V
Pin #5: P.S. -15V

Connector type: TYCO ELECTRONICS / AMP code 3-640441-5
(Farnell code 1098689)

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RS-232 command list:

INPUT	COMMAND DESCRIPTION	SENSOR OUTPUT
M	**Sensor Model:**	Sensor answers with its type and serial number. (e.g. **Mod. 4-033** for sensor LS-4 s/n 033)
r	**Reset processor**: carries out diagnostics and sets parameters to factory values.	Sensor answers **rok** in case of positive diagnostics. It sends a warning code **W00** if detector signal optimization was not complete (ended with a time-out) (sensor operation is still possible)
c	**Calibration:** carries out a manual zero setting (to be done in clean air) lasts typically 3-5 seconds.	Sensor answers **cok** at the end of the calibration procedure.
d	**Detector zeroing:** carries out a fast zero setting(to be done in clean air) lasts typically 1-2.5 seconds.	Sensor answers **dok** at the end of the calibration procedure.
l	**Fast high-res. Measurement:** gas detection command in the high resolution range. Answers in 0.5-1.5 seconds.	Sensor answers with a three digit string corresponding to the measured gas leak or concentration in the high resolution scale. If measurement was performed with a contaminated calibration, sensor sends a warning code **W04,** (thus a calibration cycle has to be performed in clean air). If the I.R. detector signal is out of range sensor sends a warning code **W01.** Try to perform a reset cycle. If the problem persists the sensor needs revision.
h	**Averaged high-res. Measurement:** Precise gas measurement command in the high resolution range. Answers in 2-4 seconds.	Sensor answers with a three digit string corresponding to the measured gas leak or concentration in the high resolution scale. (Possible answers same as above.)
j	**Fast low-res. Measurement:** gas detection command in the low resolution range. Answers in 0.5-1.5 seconds.	Sensor answers with a three digit string corresponding to the measured gas leak or concentration in the low resolution scale. (Possible answers same as above.)
FOR MULTIPLE GAS SENSORS ONLY (LS-4)		
g1 **g2** **g3** **g4**	**Gas selection:** detected gas parameters selection g1 → **R134** g2 → **R404** g3 → **R407** g4 → **R410**	Sensor answers with an acknowledge string (**g1ok**, **g2ok**, **g3ok** or **g4ok**). After power-on or a reset cycle, the sensor is always set on parameters of gas **g1** (R134).

WARNING Message List:

Warning Message	Meaning	Counter-measure
W00	The detector signal optimization procedure ended with a time-out.	Sensor is still working. Please repeat one or more reset cycles.
W01	Infrared detector signal is too low. (measurements can be performed anyway)	Please perform one reset cycle. If the problem persists sensor needs revision.
W04	Calibration took place in a polluted environment or was performed too long ago.	Please perform a new calibration cycle in a clean air.

CAUTION:

- Avoid any liquid, moisture and dust to enter the optical cell. The optical cell should be protected by an appropriate filtering stage.
- Prevent not-grounded conductors to touch the aluminum body of the optical cell. Infrared components may be permanently damaged by ESD or any external voltage.

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