Refrigerant Gas Detection Sensor

APEX-EK-RV-00 · Modbus RTU / RS-485 · Product Datasheet

0–2000	24 V	IP54	32	−10…+60
ppm range	DC supply	field enclosure	detectors / panel	°C operating

A standalone detection unit that continuously monitors refrigerant leaks in machine rooms, cold storage facilities and process cooling plants. Sensing element, measurement stage and RS-485 interface share a single enclosure, so the unit connects to existing PLC / SCADA / BMS infrastructure without a gateway or licensed software.

What it does — in 3 steps

1 · Senses	An SnO_2 semiconductor diffusion element continuously reads halogenated refrigerant concentration in ambient air at ppm level.
2 · Digitises	A 12-bit ADC with 16× oversampling converts the reading next to the sensor, so the bus carries a data frame rather than an analogue voltage.
3 · Reports	Values reach the panel or PLC over Modbus RTU; crossing a threshold triggers exhaust fans, sirens and BMS notifications.

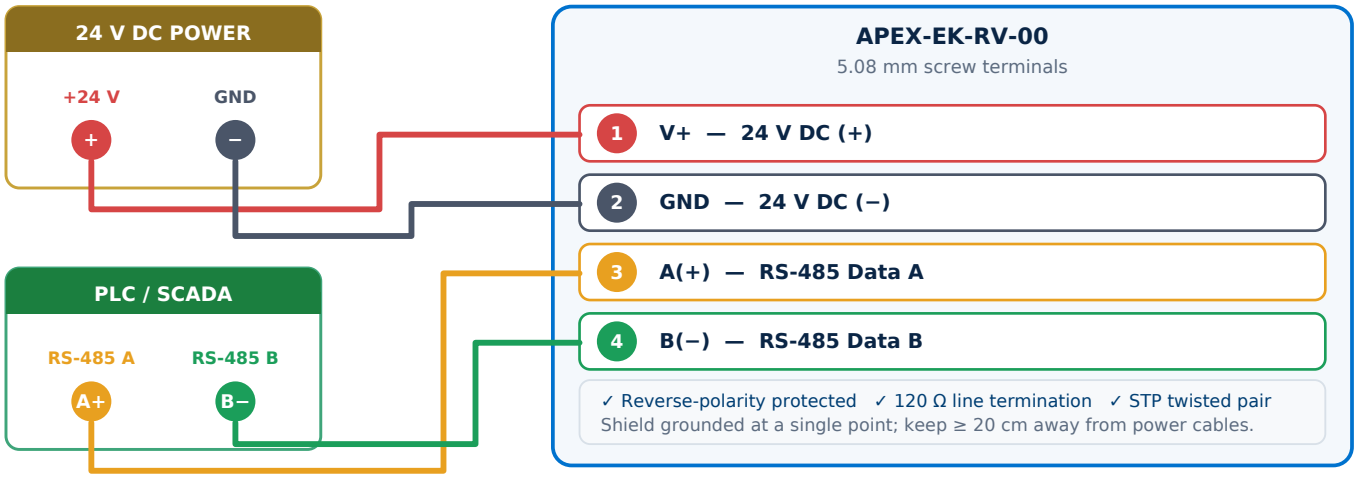
Technical specifications

Item	Value
Part number	APEX-EK-RV-00 (hardware reference CVT_FR_001)
Sensor type	Tin dioxide (SnO_2) semiconductor, diffusion type
Target gases	R-134a, R-404A, R-407C, R-410A, R-22 (halogenated hydrocarbons)
Measuring range	0–2000 ppm (subject to calibration curve)
Acquisition	12-bit ADC · 16× oversampling · ratiometric (raw ADC / VRL / Rs)
Communication	Modbus RTU slave · 2-wire half-duplex RS-485 (A+ / B−)
Baud / frame	115200 bps · 8-E-1 (default, configurable)
Function codes	0x03 / 0x04 read · 0x06 write single · 0x10 write multiple
Addressing	DIP 1–31 · with DIP = 0, 1–247 over Modbus (factory: 248)
Power supply	24 V DC · 5.08 mm screw terminals · reverse-polarity protected
On-board rails	5.0 V sensor heater · 3.3 V logic
Enclosure / rating	External field housing · IP54
Operating temperature	−10 °C … +60 °C (non-condensing)
Indicators	2 × status LEDs (heartbeat / alarm) + software identify mode

Overall dimensions, current consumption and the CE/EMC declaration are being confirmed through type testing prior to series production.

Field wiring diagram

Power (24 V DC) and RS-485 communication are wired through four 5.08 mm screw terminals.



Pin	Label	Signal	Wire	Level
1	V+	24 V DC supply, positive	Red	+12 … +24 V DC
2	GND	24 V DC supply, negative / ground	Black	0 V DC
3	A(+)	Modbus RTU RS-485 Data A	Yellow	−7 … +12 V
4	B(−)	Modbus RTU RS-485 Data B	Green	−7 … +12 V

Modbus register map

All values are 16-bit holding registers; addresses are decimal and zero-based.

Addr	R/W	Register	Description
0	R	FW version	High byte major, low byte minor (0x0100 = v1.00)
1	R	Board type	Sensor identity / variant code (0x0003)
2	R	Uptime	Seconds since power-up
3	R	Raw ADC	Sensor sense voltage, 0–4095 counts
5	R	RX frame counter	Valid Modbus frames received
6	R	Bus error counter	CRC / framing errors on the line
8	R	Sensor VRL	Sense node voltage, mV (0–3300)
9/10	R	Sensor Rs	Sensor resistance, ohm (32-bit; 0xFFFFFFFF = warming up)
16	R/W	LED mode	0 heartbeat · 1 steady · 2 off · 3 identify
17	R/W	Identify	LED blink duration used to locate the unit (s)

Practical value of the counters: if the bus error counter rises, the fault is in the wiring rather than the sensor. Alarm logic is configured on the APEX-EK-PNL panel.

System components

Part number	Description
APEX-EK-RV-00	Refrigerant gas detection sensor — Modbus RTU / RS-485, 0–2000 ppm, IP54
APEX-EK-PNL	Gas control panel — 1× Modbus input (32 detectors), 6× analogue 4–20 mA, 3 alarm + 1 fault relay (dry contact)
APEX-EK-PS	24 V DC power supply with fault output — EN 54-4, metal housing
APEX-EK-AKU-K	Sealed battery — 12 V 7.2 Ah VRLA, maintenance-free
APEX-EK-SRN-K / -B	Sounder with integrated beacon — IP21C, 100–108 dB, EN 54-3 & EN 54-23
APEX-EK-PP	Panel protection cabinet — field-type enclosure
APEX-EK-SRVS	Commissioning, functional testing and user training

Sensor placement

- 30–45 cm above floor level — HFC/HCFC refrigerants are heavier than air and pool low.
- Within 6 m of the leak source: compressor body, flange and flare joints, service valves.
- Dead zones: pits, cable trenches and stairwells must always be covered.
- A detector in the exhaust fan intake path represents the general room condition.
- Must be reachable for annual calibration without erecting a platform.

F-Gas compliance — the 500 tCO_2e threshold

Under the Turkish Regulation on Fluorinated Greenhouse Gases (Official Gazette No. 32693, 15 October 2024), a fixed leakage detection system (LDS) is mandatory for equipment holding 500 tonnes of CO_2 equivalent or more. Calculation: **tCO_2e = (charge kg × GWP) ÷ 1000**. Where a fixed system is installed, periodic manual leak-check intervals are doubled.

Refrigerant	GWP	tCO_2e at 240 kg charge	Status
R-410A	2088	≈ 501	Within mandatory scope
R-404A	3922	≈ 941	Within mandatory scope
R-134a	1430	≈ 343	Below threshold — recommended
R-32	675	≈ 162	Below threshold — recommended

Installation and commissioning

1. Site survey and risk analysis — leak-prone points and air flow directions.
2. Gas inventory and tCO_2e calculation — verification against the 500-tonne threshold.
3. Point selection and bus design — RS-485 routing and termination points.
4. Mechanical installation — detectors, panel, sounders; 24 V DC and RS-485 terminations.
5. Interlock integration — relay wiring for exhaust fans and gas shut-off valves.
6. Commissioning — addressing, bus error counter check, functional test with calibration gas.
7. Training and handover — BMS/SCADA verification and as-built documentation.

> Calibration: full calibration at least once a year. Where oil mist, heavy dust or high humidity is present, six-monthly checks are recommended. Semiconductor sensors require at least 7 days of pre-heating before the first calibration.

Contact

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