NEXILICA

Aeris

Automotive-grade PHT sensor for rough environments

Revision 1.0a

1. Features

- **Pressure, humidity and temperature in one board**
- **Wide operating range: -40 to +125 °C**
- **Absolute pressure 15–400 kPa, ±3.8 kPa typ.**
- **Relative humidity 0–100 %RH, ±2 %RH typ.**
- **Temperature accuracy ±0.2 °C typ.**
- **Condensation-proof, with anti-condensation heater**
- **Factory-calibrated; auto-identified on the carrier**
- **Supplied soldered on the Nexor carrier; 21 × 14 mm**

2. Applications

- HVAC and building climate monitoring
- Industrial process and enclosure monitoring
- Weather and barometric / altitude sensing
- Engine-bay and other high-temperature environments
- Condensation-prone and high-humidity environments

3. Description

Aeris is a pressure–humidity–temperature (PHT) sensor daughterboard for the Nexilica *Nexor* carrier. It combines a MEMS absolute-pressure sensor and a digital humidity-and-temperature sensor on a single compact board that is soldered directly onto one face of the carrier through its castellated pads. The carrier supplies power and reads all three measurements, publishing them on the CAN bus, so Aeris needs no separate supply or wiring of its own.

Both sensing elements are individually factory-calibrated, and the board uses automotive-grade, RoHS-compliant components. It operates from -40 °C up to +125 °C, and the humidity sensor stays fully functional in condensing conditions, with an integrated heater that the carrier can pulse to clear condensation from the sensor surface. An on-board memory lets the carrier recognise Aeris automatically and apply the matching calibration.

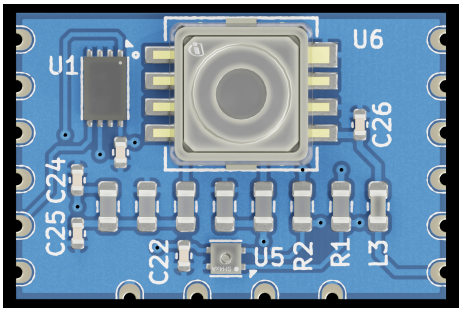


Figure 1: Aeris sensor board

4. Technical Characteristics

Absolute maximum ratings

Stresses beyond those listed in Table 1 may cause permanent damage to the device. These are stress ratings only; functional operation at or beyond the values listed under *Electrical and environmental characteristics* is not implied.

PARAMETER	MIN	MAX	UNIT
Applied pressure (1)	10	600	kPa
Storage temperature	-40	+150	°C

Table 1: Absolute maximum ratings

(1) 400 kPa continuous; up to 600 kPa for a limited time (≤300 s). Device-level ESD robustness of the fitted components is ≥2 kV (human-body model).

Sensing performance

Table 2 summarises what each sensing channel delivers. These are the figures that matter for the measurement; supply and environmental limits follow in Table 3.

MEASURAND	RANGE	ACCURACY	RESOLUTION	RESP. TIME (t_{63})
Absolute pressure	15 – 400 kPa (1)	±3.8 kPa (2)	0.12 kPa (3)	5 ms (5)
Relative humidity	0 – 100 %RH	±2 %RH typ. (4)	0.01 %RH	4 s
Temperature	-40 – +125 °C	±0.2 °C typ.	0.01 °C	2 s

Table 2: Sensing performance

(t_{63}) Time to reach 63% of a step change. (1) 0.15–4.0 bar absolute. (2) Maximum error band of the sensing element over 0–100 °C, widening to ±4.9 kPa at +125 °C and ±5.6 kPa at -40 °C. It covers the sensing element only: the tolerance of the on-board signal conditioning and of the carrier ADC reference is removed by the board calibration. (3) Digitised by the carrier 12-bit ADC; output noise ≤0.2 kPa RMS. (4) At 25 °C; best within 5–60 °C and 20–80 %RH. Functional in condensing conditions; prolonged exposure above 80 %RH temporarily offsets the reading (typ. +3 %RH after 60 h), which recovers by itself once back

in range. [5] Board-level figure, set by the on-board anti-aliasing and EMI filter (−3 dB at 38 Hz); the sensing element alone settles in under a millisecond.

Long-term stability (typ.): relative humidity <0.2 %RH per year, temperature <0.03 °C per year. The humidity and temperature accuracies are typical values; the guaranteed limits widen toward the range extremes.

Electrical and environmental characteristics

All supply rails are provided by the carrier; Aeris requires no external supply.

PARAMETER	MIN	TYP	MAX	UNIT
Operating temperature	-40	—	+125	°C
Operating pressure (absolute)	15	—	400	kPa
Operating relative humidity	0	—	100	%RH
Supply current, 5 V rail [1]	—	8	10	mA
Supply current, 3.3 V rail [2]	—	0.02	—	mA
Heater current, when enabled [3]	—	—	35	mA

Table 3: Electrical and environmental characteristics

[1] Pressure-sensing supply; a peak of up to 22 mA is drawn for a few milliseconds at power-up. [2] Idle figure, humidity sensor sampled at 1 Hz; the on-board I^2C pull-ups add ∼0.7 mA per line while the bus is held low. [3] Anti-condensation heater on the 3.3 V rail, pulsed by the carrier at ≤10% duty cycle. The value is a bound for supply design: at 3.3 V the heater delivers less than the 200 mW specified for the sensor at 5 V, so the heating power on this board is correspondingly lower.

5. System architecture and carrier interface

Aeris has no wired connector: it is soldered onto the castellated pad strip of one face of the Nexor carrier (16 pads: two side columns of 6 at 2.27 mm pitch and a bottom row of 4 at 3.30 mm pitch, see Figure 4), and all power and signals are exchanged through those pads. The pressure sensor delivers an analog voltage proportional to absolute pressure, conditioned on board for the carrier analog input; the humidity-and-temperature sensor is digital and is read over the face sensor bus; and a small identification memory sits on the shared ID bus. Everything is powered from the carrier. Table 4 lists the carrier resources the board uses.

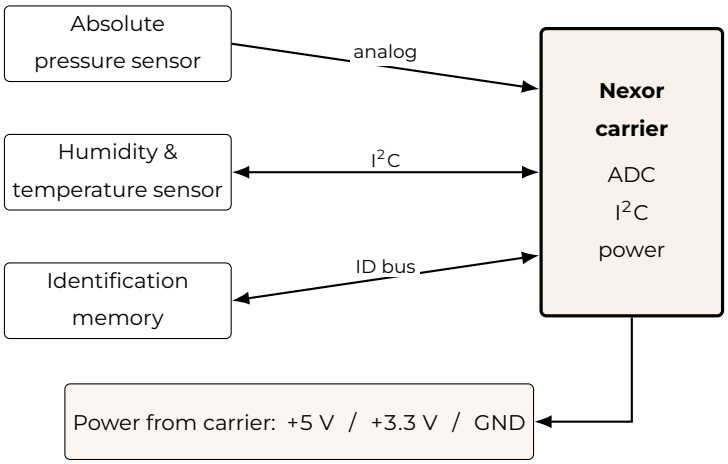


Figure 2: System block diagram. Aeris conditions the sensor signals; the carrier digitises, reads and publishes them.

FUNCTION	CARRIER RESOURCE	DESCRIPTION
Pressure signal	Analog input (ADC)	Conditioned analog voltage proportional to absolute pressure
Humidity & temperature	Sensor I^2C bus	Digital humidity and temperature readout
Board identification	Shared ID bus + site-select pad	Identification / calibration memory; address set by the mounting face
Power	+5 V, +3.3 V, GND	Supplied by the carrier

Table 4: Resources used on the carrier face

6. Communication and output data

Aeris runs no firmware of its own: the Nexor carrier samples the three channels, applies the board calibration and publishes the results on the CAN bus. From the application side Aeris therefore appears as a source of three measured values:

- **Absolute pressure**
- **Relative humidity**
- **Temperature**

The units, scaling, CAN identifiers, message layout and the measurement update rate are defined by the carrier firmware and its CAN protocol, not by this board; refer to the Nexor carrier and firmware documentation for the exact encoding. Valid sensor data is available within about 40 ms of the rails powering up, so the first values are published as soon as the carrier completes its boot sequence.

The anti-condensation heater is not free-running: it is activated on demand by the carrier, and the published humidity and temperature are not specified while the heater is on.

7. Hardware

7.1 Absolute pressure sensing

Pressure is measured by a capacitive MEMS absolute-pressure sensor with an on-chip, factory-calibrated and temperature-compensated signal path. It covers 15–400 kPa absolute (0.15–4 bar) with a typical accuracy of ±3.8 kPa over 0–100 °C, widening to ±4.9 kPa at the top of the board temperature range. The sensing element itself settles in under a millisecond; on the board its output passes through an anti-aliasing and EMI filter before reaching the carrier, which sets the channel bandwidth to about 38 Hz (5 ms to 63% of a step). The sensing element tolerates short overpressure up to 600 kPa.

7.2 Humidity and temperature sensing

Relative humidity and temperature come from a digital, individually calibrated sensor with a CRC-protected readout. Humidity is measured across the full 0–100 %RH range with a typical accuracy of ±2 %RH and 0.01 %RH resolution; temperature is measured from -40 to +125 °C with a typical accuracy of ±0.2 °C. Each part carries a unique serial number set at production.

7.3 Condensation handling

The humidity sensor is designed to stay fully functional in condensing environments: condensed water does not harm it, it only makes the reading unresponsive to the air until the surface is dry again. An integrated heater, activated on demand by the carrier in pulses of 0.1 s or 1 s, drives off condensed or sprayed water and counteracts drift in persistently humid conditions. The heater is controlled through the carrier (not directly by the user); it is intended for intermittent use (10% maximum duty cycle) and for ambient temperatures below about 65 °C. It runs from the 3.3 V rail and therefore delivers less than the 200 mW specified for the sensor at 5 V, so clearing the surface takes correspondingly longer.

7.4 Power

The board takes its power from the carrier: the pressure sensor runs from the 5 V rail (filtered on board against supply noise), while the humidity-and-temperature sensor and the identification memory run from the 3.3 V rail. No external supply or regulation is required. Excluding the heater, the board draws roughly 8–10 mA, almost all of it on the 5 V rail.

7.5 Board identification and calibration

A small memory on the shared identification bus holds a board code, serial number and calibration data. Its bus address is set by the mounting face of the carrier, so a board on the TOP face and one on the BOTTOM face are distinguished even when two Aeris boards

are fitted. At power-up the carrier reads this memory, recognises the board and loads the matching configuration and calibration.

7.6 Mounting and media exposure

Aeris is soldered onto one face of the carrier through 16 castellated pads: two side columns of 6 at 2.27 mm pitch and a bottom row of 4 at 3.30 mm pitch. The sensing elements face outward and must be left exposed to the air or gas being measured; the humidity sensor needs an unobstructed air path, and the gel-protected pressure port should see only clean, dry, non-corrosive gases. Avoid liquids, conductive contaminants and mechanical contact with the sensor openings.

The sensor openings are not sealed and the board carries no ingress rating on its own. In dusty, wet or splash-prone installations (for example an engine bay), fit the node in an enclosure with a vented, water-repellent membrane that lets the measured air reach the sensors while keeping out liquids and particulates.

7.7 Conformal coating (option)

For persistently humid atmospheres and for salt-laden air, Aeris and the carrier can be supplied with an acrylic conformal coating that protects the electronics against oxidation. The coating is applied at Nexilica during assembly, with the pressure port and the humidity sensor masked so that both stay open to the measured air; masking is what makes it a factory option rather than a field treatment. With the openings masked, the sensing path is untouched and the figures given in this datasheet still apply. See Section 11 to order a coated node.

8. Compliance and qualification

8.1 Component grade

Aeris is built throughout with automotive-grade components. The humidity-and-temperature sensor and the identification memory are AEC-Q100 qualified, the pressure sensor is an automotive-qualified device, and the passive components are automotive-grade parts. This grading underpins the wide -40 to +125 °C operating range and the suitability for harsh environments.

8.2 Environmental compliance

The board is RoHS compliant and of lead-free construction. REACH/SVHC and full material declarations are available on request.

8.3 Assembly and handling

Aeris is soldered onto the Nexor carrier at Nexilica, with a lead-free reflow process (IPC/JEDEC J-STD-020), and is delivered as part of the assembled node: no soldering, mounting or rework is required on the user side.

The sensing elements stay contamination-sensitive after assembly. Keep the node in its sealed packaging until installation, away from solvents, out-gassing adhesives, tapes and packaging materials, and do not clean the board or apply solvents to the sensor openings.

9. Use cases

Aeris turns a Nexor node into a wide-range environmental sensor. The table below lists how it is typically used.

USE CASE	DESCRIPTION
Climate monitoring	Report ambient pressure, humidity and temperature from HVAC ducts, cabinets and rooms over the CAN bus
Harsh / hot environments	Operate where temperatures reach +125 °C, such as engine bays and industrial enclosures, beyond the reach of ordinary environmental sensors
High-humidity and condensing service	Measure reliably where condensation forms, using the on-board heater to recover the humidity reading and prevent long-term drift
Barometric / altitude sensing	Use the absolute-pressure channel for weather, altitude or air-pressure measurements
Dual-sensor node	Combine Aeris with a second daughterboard on the other carrier face to build a single CAN node exposing two sensing functions

Table 5: Typical use cases

10. Mechanical dimensions

Aeris is a 2-layer PCB measuring 21.00 × 13.95 mm, 1.6 mm thick, with castellated pads on its edges (two side columns of 6 at 2.27 mm pitch and a bottom row of 4 at 3.30 mm pitch) that are soldered onto one face of the Nexor carrier. The board carries no connector and no mounting holes; it is held and supported by the solder joints to the carrier, and the sensing elements sit on the side that faces away from the carrier. The top view below gives the overall outline dimensions and the position of the castellated pads, of the pressure sensor and of the humidity sensor.

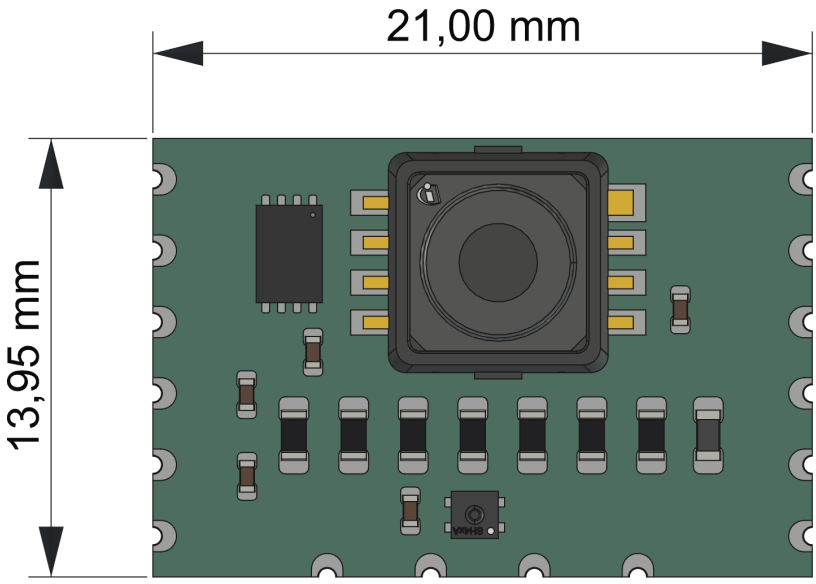
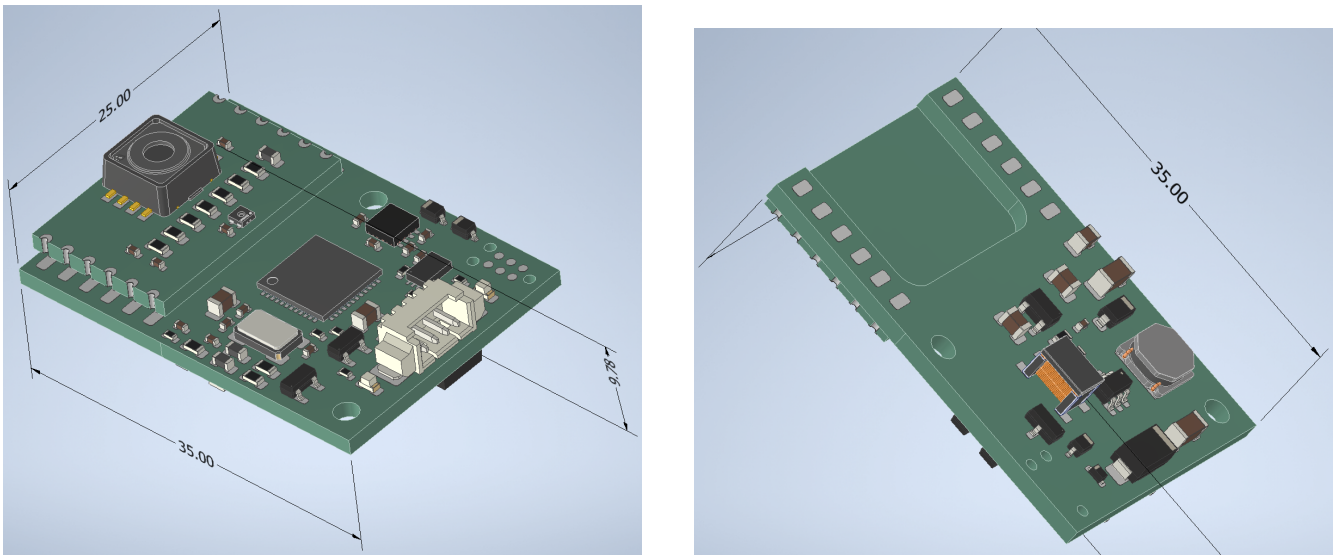


Figure 3: Board outline, pad map and overall dimensions

Assembled on the carrier

Aeris adds no footprint of its own: once fitted, the node keeps the 35.00 × 25.00 mm outline of the Nexor carrier, and the overall height of the assembly — from the top of the pressure sensor down to the lowest part on the carrier underside — is 9.78 mm. Figure 4 (a) shows the board soldered to one carrier face, with the sensing elements facing away from the carrier. The opposite face keeps its own pad footprint free (b), so a second daughterboard can be fitted there to build a two-function node.



(a) sensing face (b) opposite face

Figure 4: Aeris fitted to the Nexor carrier: (a) assembly outline and overall height, with the sensors facing outward; (b) the opposite carrier face, its daughterboard pad footprint left free

11. Ordering information

Aeris is supplied already soldered onto a Nexor carrier, as a ready-to-use node; it is not sold as a loose board for customer assembly. It carries no separate order option for accuracy or interface; the single configuration is described in this datasheet.

For humid or salt-laden environments the node can be ordered with the acrylic conformal coating described above, applied to both Aeris and the carrier. State it when ordering; contact Nexilica for the corresponding order code.

PRODUCT	ORDER CODE	DESCRIPTION
Aeris	NXL-AERIS-10A [1]	PHT sensor daughterboard, revision 1.0a, factory-mounted on the Nexor carrier

Table 6: Ordering information

[1] Preliminary order code, subject to confirmation. Contact Nexilica for availability and quantities.

Revision history

DATE	REVISION	CHANGES
2026-07	1.0a	First release

Table 7: Revision history