

TECHNICAL NOTE

TMH-05P3 / TMH-10P3 — Applications and Reliability

This note complements the technical datasheets of the TMH-05P3 (code 21600005021100001) and TMH-10P3 (code 21600010021100001) closed-loop Hall-effect voltage transducers. It details the application areas these two references are suited to and the design features that support their reliability in each of them, based on the electrical and environmental data confirmed in the manufacturer source documents.

1. Product identity confirmed from source data

Both references are ADISENS in-house closed-loop Hall-effect voltage transducers, confirmed with ADISENS as voltage transducers despite a header label on the source datasheets reading "Current Transducer" — an inconsistency in the source document layout, not in the product. The measurement principle: the primary side is crossed by a current proportional to the voltage to be measured, set by a series resistor (R1); a Hall-effect sensor (H) detects the magnetic field created by that primary current; an internal amplifier drives a secondary current that exactly compensates this field (the "closed-loop" operation); and that secondary current, once passed through a measuring resistor (RM), produces an output voltage that is a fast, accurate image of the primary voltage — with galvanic isolation maintained between the two circuits throughout.

Parameter	TMH-05P3	TMH-10P3
Rated input voltage (VPN)	5 V (range ± 1200 V)	10 V (range ± 500 V)
Turn ratio (Np/Ns)	5000 / 1000	2500 / 1000
Output current (IPN / IS)	5 mA / ± 25 mA	10 mA / ± 25 mA
Accuracy @ IPN, 25 °C	$< \pm 0.5$ %	$< \pm 0.5$ %
Linearity error	< 0.2 % FS	< 0.2 % FS
Response time (90 % of IPN)	< 40 μ s	< 40 μ s
Insulation voltage	2.5 kV (50/60 Hz, 1 min AC)	2.5 kV (50/60 Hz, 1 min AC)
Operating / storage temperature	$-40 \dots +85$ °C / $-55 \dots +125$ °C	$-40 \dots +85$ °C / $-55 \dots +125$ °C
Mass	22 g	22 g

The two references share the same closed-loop Hall-effect architecture, accuracy class, response time and insulation rating; they differ only in rated input voltage and turn ratio, letting the same reliability profile be applied across a wider measuring range simply by choosing the calibre matching the bus voltage.

2. Applications

The manufacturer source lists five application families for the TMH range. Each is expanded below with the transducer characteristic that makes it a good fit.

2.1 AC/DC variable-speed drives

Variable-speed and variable-frequency drives require accurate monitoring of the DC bus and motor-side voltages to regulate torque and speed and to protect the power stage from overvoltage. The TMH's closed-loop Hall-effect measurement tracks both DC and AC components of the bus voltage with the same $< \pm 0.5$ % accuracy and < 40 μ s response time, so the drive's control loop sees a fast, low-drift image of the real voltage across the full range of switching conditions, including fast transients created by PWM switching.

2.2 Power inverters and renewable energy systems

Inverters for solar or wind installations must monitor DC-link voltage against safety and grid-code thresholds, often in outdoor or enclosure environments with wide temperature swings. The TMH's $-40 \dots +85$ °C operating range and its bounded offset-current temperature coefficient ($< \pm 0.5$ mA/°C) keep the measurement stable as ambient conditions vary through the day, while the 2.5 kV insulation voltage and galvanic isolation protect low-voltage control electronics from the high DC-link potentials typical of these systems.

2.3 Uninterruptible power supplies (UPS)

A UPS must detect input mains loss and switch to battery/inverter operation within milliseconds, then confirm output voltage quality once back on load. The TMH's fast response time supports rapid voltage-transfer decisions, and its high linearity ($<0.2\%$ FS) keeps measurement error small across the full voltage swing seen during transfer events, so the transfer logic is not fed a distorted or lagging voltage reading.

2.4 Switch-mode power supplies (SMPS)

SMPS topologies switch at high frequency and generate significant electromagnetic interference; voltage feedback loops must reject this noise to hold regulation. The transducer's high immunity to external interference (a design property of the closed-loop Hall-effect measurement, which cancels flux internally rather than relying on a passive sense element) keeps the output signal clean, allowing tight voltage regulation without adding external filtering that would otherwise slow the control loop.

2.5 Industrial automation and control systems

General industrial control cabinets combine multiple voltage domains, long cable runs, and shared enclosures with other switching equipment, so isolation and mechanical robustness matter as much as accuracy. The TMH's galvanic isolation, compact PBT G30/G15 (UL94-V0) housing and 22 g mass make it straightforward to integrate on a PCB or DIN-rail assembly alongside other automation components without adding a distinct safety-isolation stage.

3. Reliability factors common to both references

- **Measurement principle** — Closed-loop Hall-effect measurement principle, which actively cancels the magnetic flux from the measuring resistor's current rather than only sensing it passively — this is the main contributor to the $\pm 0.5\%$ accuracy and $<0.2\%$ FS linearity holding across the full measuring range, not only near nominal.
- **Thermal stability** — Bounded temperature drift on the offset current ($<\pm 0.5$ mA/°C over $-40\dots+85^\circ\text{C}$) keeps zero-point error predictable across the full industrial temperature range rather than only at 25°C , which matters for any application running outdoors or in unconditioned enclosures.
- **Galvanic isolation** — 2.5 kV (50/60 Hz, 1 min AC) insulation voltage between primary and secondary circuits, combined with galvanic isolation, protects downstream control and measurement electronics from the high-voltage primary side — a requirement in every application listed above, all of which mix a high-voltage power stage with low-voltage control logic.
- **Response speed** — <40 μs response time to 90% of IPN supports control loops that must react to fast transients (drive switching events, UPS transfer, SMPS load steps) without the measurement itself becoming the bottleneck.
- **Standards compliance** — Compliance with IEC 60950-1 (safety of information-technology and similar electronic equipment), EN 50178 (electronic equipment for use in power installations) and SJ20790, together with an intended-use and installation framework aligned with IEC 61010-1, gives each application a documented basis for the equipment-level safety case it needs to build around the transducer.
- **Range scalability** — Identical accuracy, linearity, response time, insulation and thermal specifications across TMH-05P3 and TMH-10P3 mean a system designed around one calibre can be re-scaled to the other, for a different bus voltage, without re-validating the reliability behaviour of the sensor itself — only the input voltage and turn ratio change.