SAFEBACK | SMART AQUACULTURE | GUANGZHOU, CHINA

Fixed Water Quality Monitoring Station

4G to cloud · four RS485 channels · DO / pH / ORP / salinity / temperature

Product datasheet (EN) · Rev. 2026-10 · Vietnam market

1. Product overview

The Fixed Water Quality Monitoring Station is a bank-side monitoring set for intensive aquaculture ponds. At its centre is a 4G IoT gateway; sensors hang below it on an RS485 bus, and readings go up to the cloud over 4G. The pond-side screen and the phone app back each other up, so an outage on one side does not blind the farm.

The system is sold as "terminal plus probes", configured to the pond rather than to a fixed bundle. If the only worry is a night-time oxygen crash, take the terminal and one DO probe. To watch water stability as well, add pH and ORP. For brackish shrimp ponds where salinity swings with the monsoon, switch to the integrated multi-parameter probe that reads five parameters at once.

The station has one job: show the trend before oxygen runs out, rather than counting dead shrimp at sunrise. The fluorescence DO probe needs no membrane and no electrolyte, so it can stay submerged and keep producing data month after month . That is what decides whether a station is still in use a year later.



Fig. 1 Monitoring station controller TK-4G-GW: a DIN-rail 4G gateway, RS485 sensors below, 4G uplink to cloud

2. Key features

- **Plug and play, auto-detection** — the terminal recognises the probe type and starts reading; no on-site programming, no address table to fill in.
- **Fluorescence DO, no consumables** — membrane-free and electrolyte-free, so pH swings, ammonia and heavy metals in the water do not disturb the reading, and there is no monthly membrane change.
- **4G to cloud — readings go straight to the platform and are visible on phone or web from anywhere. When the network drops the gateway caches the data and back-fills it when the link returns.**
- **Four RS485 ports** — up to four discrete probes on one terminal, or a single multi-parameter probe covering five parameters on one port.
- **Wide 6–36 V DC input** — runs from a 12 V adapter, a battery, or a stepped-down 48 V system supply, which leaves the power plan open on remote ponds.
- **Industrial temperature range** — the terminal is rated −30 to +75 °C, covering open-air sun in the south and cool pre-dawn hours in the north.
- **Plug-in SIM, local data** — the terminal takes a standard IoT SIM, so data is bought on the customer's own market and carrier. The domestic version ships with a Chinese card and three years of traffic; export units ship without a card.
- **Part of one SAFEBACK system** — pairs with the SAFEBACK 4G gateway, cloud platform and DC 48 V power system, so adding aeration control later needs no new platform.

3. System composition and TK model coding

The complete system carries the model **TK-WQS** (Water Quality Station), built from one terminal and a set of probes. Each component has its own model number, can be ordered separately and replaced on its own — you do not scrap a station because one probe has died.

Every SAFEBACK aquaculture product carries the **TK** prefix: **TK – category code + specification number**. The two-letter code identifies the category; the number carries the single most important figure for that product — rated power in watts for powered equipment, measured parameters ×100 for sensors, screen size ×100 for terminals. One coding rule across the range, so a customer can tell from the model number what a unit is and what class it belongs to.

Code	Category	Model	What the number means
GW	4G IoT gateway	**TK-4G-GW**	4G Cat.1 uplink (role-based code)
DO	Fluorescence DO sensor	**TK-DO100**	Single parameter
PH	pH sensor	**TK-PH100**	Single parameter
ORP	ORP sensor	**TK-ORP100**	Single parameter
MP	Multi-parameter probe	**TK-MP500**	Five parameters

Code	Category	Model	What the number means
YL	Impeller aerator	TK-YL1500	Rated power 1500 W
YC	Waterwheel aerator (mains)	**TK-YC750SL**	Rated power 750 W, twin impeller
YC	Waterwheel aerator (mains)	**TK-YC1500SL**	Rated power 1500 W, four impellers
FS	Pneumatic (air-blower) feeder	TK-FS2000	Rated power 2000 W, 30 m throw
—	Two-bag feeder	TK-150D	150 kg/h class; D = dual hopper

The station is how you see, the aerator is how you put oxygen in, the feeder is how you put feed in — one model range, one protocol. Buy the station this season and add aerator control next season; the interfaces already match.

The station is not one box. It is a terminal plus a set of probes. The three configurations below cover the three most common requirements on Vietnamese ponds.

Configuration	Composition	Parameters monitored	Where it fits
A — Basic	TK-4G-GW ×1 + TK-DO100 ×1	DO, water temperature	Freshwater fish ponds where oxygen is the one red line; budget-first projects
B — Standard	TK-4G-GW ×1 + TK-DO100 + TK-PH100 + TK-ORP100	DO, temperature, pH, ORP	Intensive freshwater fish ponds and freshwater shrimp ponds; watching water stability and organic load
C — Full parameter	TK-4G-GW ×1 + TK-MP500 ×1	DO, pH, ORP, salinity, temperature	Brackish shrimp ponds, hatcheries, crab ponds — anywhere salinity has to be watched

A and B use discrete probes that are replaced one at a time, which keeps long-term maintenance cheap. C uses one integrated probe with a single cable and a single port, the simplest installation, at a higher unit price. Configurations upgrade without a new terminal: add probes to A to reach B, or swap the probes for the integrated unit to reach C.

4. Technical specifications

4.1 Data terminal TK-4G-GW

Item	Specification
Controller	TK-4G-GW 4G IoT gateway; DIN-rail enclosure, IP65 bare unit
Cellular	4G Cat.1, full band (ML307A module); local carrier IoT SIM
Cloud protocol	MQTT, data uploaded to the platform in real time
Sensor ports	4 × RS485 (Modbus RTU master); up to 64 slave addresses
Power	DC 12 V input, adapter rated ≥ 2 A continuous (adapter not included)
Local display	Optional external touchscreen on the same RS485 bus; not in the standard scope
Operating environment	−20 to +60 °C, 5–95% RH non-condensing
Ingress protection	IP65 bare unit, outdoor mounting; a rain cover is advised where sun exposure is long
Functions	Automatic sensor recognition, plug and play; threshold alarms; local rules keep running when the network drops; multiple data formats, expandable
Included service	China version: 3 years of data traffic. Export version: no SIM, use a local IoT SIM
Warranty	1 year, complete unit, from date of manufacture

4.2 Discrete probes TK-DO100 / TK-PH100 / TK-ORP100

Item	DO TK-DO100	pH TK-PH100	ORP TK-ORP100
Measuring principle	Fluorescence quenching (no membrane, no electrolyte)	Glass electrode, flat bulb	Flat platinum electrode with Ag/AgCl reference; redox potential
Range	0–20 mg/L (ppm); 0–200 % saturation	0–14 pH	±1000 mV
Resolution	0.01 mg/L	0.01 pH	0.1 mV
Accuracy	Below 5 mg/L: ±0.2 mg/L; above 5 mg/L: ±0.3 mg/L	±0.1 pH	±4 mV
Repeatability	0.2 mg/L	—	±10 mV
Temperature / compensation	0–40 °C, accuracy ±0.1 °C	Automatic compensation (NTC)	Not applicable (no measuring-mode temperature compensation for ORP)
Response time	DO T90 < 30 s; temperature T80 < 300 s	60 s (T90)	T90 < 30 s
Interface	RS485, Modbus RTU, 9600 bps	RS485, Modbus RTU	RS485, Modbus RTU
Power	12 V DC (28 V DC withstand), 20 mA	12–24 V DC	12–24 V DC
Ingress protection	Waterproof to 10 m depth	IP68, depth < 20 m	IP68, depth < 20 m
Body material	Stainless steel	POM	POM with clear guard
Dimensions	Head Ø 24 mm, overall length 14 cm	Head Ø 30 mm, length 197 mm	Ø30 × 197 mm (same body as pH)
Cable	30 m standard, custom lengths available	30 m standard, custom lengths available	30 m standard, custom lengths available
Cable termination	—	—	Waterproof aviation connector
Calibration	Air-saturation check, no routine calibration	Two-point (pH 4.00 / 6.86 / 9.18)	Single-point (468 mV standard)
Service life	Fluorescent cap, 3 years	1 year or more	1 year or more
Warranty	2 years	1 year	1 year

"—" means the item does not apply or is not specified. All three probes ship with a 30 m cable as standard; longer or shorter runs must be stated on the order, and custom lengths take one week. The 3-year figure for the DO probe is the reliable working life of the fluorescent cap, a different thing from its 2-year warranty. ORP measures electron activity, so no temperature compensation is applied during measurement; it is calibrated at 25 °C with a single 468 mV standard. The ±4 mV quoted is whole-instrument accuracy including reference drift and junction potential — tighter numbers on a datasheet are electrical resolution, not reproducible accuracy.



Fig. 2 Fluorescence dissolved oxygen probe: stainless-steel body, optical window at the head, no membrane and no electrolyte



Fig. 3 pH probe: flat bulb with ceramic-junction reference, double O-ring seal, 30 m cable as standard



Fig. 4 ORP probe: flat platinum electrode behind a clear guard, mounted the same way as the pH probe

4.3 Integrated multi-parameter probe TK-MP500

One probe carries five parameters and occupies a single RS485 port on the terminal.

Parameter	Principle	Range	Accuracy
Dissolved oxygen	Fluorescence quenching	0–20 mg/L or 0–50 mg/L; 0–200 % or 0–500 %	0–20 mg/L: ±0.3 mg/L; 20–50 mg/L: 8 %
pH	Glass bulb electrode	0–14 pH	±0.2 pH
ORP	Platinum electrode	+999 mV to −999 mV	±20 mV
Salinity	Four-electrode AC drive	0–70 ppt	1 % FS
Temperature	NTC	0–45 °C	±0.2 °C

The integrated design is compact and quick to handle, suited to spot checks as well as fixed-point installation. All five values leave the probe on a single RS485 (Modbus RTU) line, so it takes one port and one cable, with no depth offset or response mismatch between separate probes. The Modbus register map is available on request for customer-side integration. Warranty 1 year.



Fig. 5 Integrated multi-parameter probe: DO, pH, ORP, salinity and temperature from a single body

5. How it works

1. **Sense** — each probe holds one RS485 address and publishes its reading under Modbus RTU on a polling cycle.
2. **Collect** — the terminal polls all four channels, recognises model and range automatically, and normalises the data.
3. **Read it anywhere — data goes to the cloud over 4G, so live values and history sit on the app and the web console, on site or off it.**
4. **Upload** — the terminal pushes data to the cloud over 4G, building history curves that can be viewed remotely with alarms.
5. **Review** — stored history lets you reconstruct an oxygen event and check what a feeding or aeration change actually did.

How the fluorescence DO reading is made: a dye at the probe tip is excited by blue light and emits red; oxygen molecules quench that emission, so more oxygen means less fluorescence. Measuring the phase and intensity shift gives dissolved oxygen without consuming oxygen and without electrolyte — which is why the probe can stay submerged and read continuously.

6. Installation and site requirements

- **Position** — where the water represents the pond as a whole, away from direct aerator flow and away from feeding points. A stagnant corner and the inlet channel are equally unrepresentative.
- **Probe depth** — in the farmed water layer, not touching the bottom. Benthic species and crab ponds need a deeper setting. Never bury the DO probe in sludge.
- **Mounting** — terminal on a dike post, pump-house wall or in the office, screen facing the

walkway; probes suspended from a bracket or buoy, with cable routed along the dike and protected against sun and ageing.

- **Power** — the terminal takes 6–36 V DC and needs an AC 220 V → DC 12 V adapter (≥1 A), a battery, or a stepped-down 48 V system supply. Probes draw from the system bus (pH and ORP 12–24 V DC, DO 12 V DC). **The adapter is not included**: export units ship without one because plug types and mains voltages differ, so the customer buys it locally; for the domestic version it can be added to the order.
- **Cable runs** — all three probes ship with a 30 m cable as standard, enough for most ponds. For runs beyond 30 m, state the length on the order and we make the cable to order (one week lead time). The ORP probe terminates in a waterproof aviation connector, so it can be unplugged on site without water ingress.
- **Ingress protection** — the terminal is an IP65 rainproof enclosure and can be mounted outdoors on a post or wall; keep the cable glands facing down and tighten them after wiring.
- **Calibration** — pH needs two-point calibration; ORP takes a single-point calibration with 468 mV standard; fluorescence DO needs no routine calibration, an air-saturation check every 3–6 months is enough. A small starter set of calibration solutions is included (pH 4.00 / 6.86 / 9.18 and ORP 468 mV), enough for commissioning and the first calibration; refills are available from us.
- **Cleaning** — biofouling coats the measuring surface, so lift and clean every 2–4 weeks, and weekly during an algal bloom. Recalibrate as required after cleaning.
- **Lightning and earthing** — in Vietnam's storm belt, fit surge protection on the 4G antenna and the supply side, and earth the enclosure properly.

7. Target species and applications

The principle is simple: watching dissolved oxygen alone covers half the risk. A stable pond watches DO, temperature and pH together; a shrimp pond adds salinity and ORP.

- **Freshwater fish ponds** — pangasius / basa (*cá tra*), tilapia (*cá rô phi*), grass carp, common carp. DO, temperature and pH are the core set; the 2–5 a.m. trough is the critical window, and only a curve shows it.
- **Brackish shrimp ponds** — whiteleg shrimp (*tôm thẻ chân trắng*) and black tiger shrimp (*tôm sú*). DO, salinity and pH; the molting stage is oxygen-critical, so continuous monitoring is a hard requirement. Only the integrated probe reads salinity, so shrimp ponds should take configuration C.
- **Crab ponds and benthic species** — bottom-layer oxygen matters, so the probe depth has to go down to the farmed layer.
- **Hatcheries and high-density lined ponds** — the thinnest safety margin, where one oxygen event is a whole-tank loss; use two probes for redundancy.

- **Source water and inlet channels** — check water before it enters the pond rather than after.

Set alarm lines in three tiers — safe, alert, danger. For DO, a common safe floor is around 3–4 mg/L, tuned to species and stocking density. Put the thresholds into the terminal and the cloud platform; do not keep them in your head.

8. Notes for regional markets

This unit runs on DC 12 V and never connects to the grid directly — there is always an adapter or a power supply in between. So what differs is not the voltage level, but the adapter's input range, the radio bands and the certification. Check the table first.

Country / region	Single-phase	Three-phase	Frequency	Relation to this unit
Vietnam	220 V	380 V	50 Hz	Identical
Thailand	220 V	380 V	50 Hz	Identical
Indonesia	220 V	380 V	50 Hz	Identical
Cambodia	220 V	380 V	50 Hz	Identical
Bangladesh	220 V	380 V	50 Hz	Identical
Mongolia	220 V	380 V	50 Hz	Identical
Myanmar	230 V	400 V	50 Hz	+5%
Singapore	230 V	400 V	50 Hz	+5%
Malaysia	240 V	415 V	50 Hz	+9%
India	230 V	400 / 415 V	50 Hz	+5–9%
Philippines	220 V	380 / 480 V	60 Hz	Frequency differs

8.1 Fully compatible — 380 V / 50 Hz

- **Vietnam, Thailand, Indonesia, Cambodia, Bangladesh, Mongolia** — These six markets use the same low-voltage system as China: 380 V three-phase, 220 V phase-to-neutral, 50 Hz. The machine connects directly — no transformer, no re-wound motor. This is where the TK series is easiest to sell against European or American equipment.
- **Vietnam is the reference market** — 0.4 kV three-phase four-wire, 380 V between phases, 220 V phase-to-neutral, 50 Hz — the same as China. Small ponds in the south often have only a single-phase 220 V service, or three-phase with too little capacity; tell us the service type, transformer rating and existing load before ordering. If a single-phase machine is required, specify the D configuration.
- **Phase loss and voltage sag** — Voltage sag at the end of a rural feeder, and phase loss, are the number-one cause of burnt motors — not the voltage level. Fit a phase-failure overload relay per machine; if you run demand-based aeration (C configuration), the control board already provides that protection.

8.2 Wide-range coverage — 400 to 528 V / 50 Hz

- **Malaysia 415 V, India 400–415 V, Singapore 400 V, the Philippines 480 V — no transformer**

needed — These voltages look higher than 380 V, but they are not a problem for our machines: the control supply is a 90–528 VAC wide-range input. Single-phase 220 V, 380 V phase-to-phase, 440 / 480 V — all accepted, and 100–745 VDC as well. No step-down transformer, no country-specific model. One machine covers Southeast Asia.

- **CE covers 100–400 VAC only — say so plainly** — Operation between 480 and 528 VAC is fine, but it sits outside the CE certification range. Quote within 400 VAC for tenders and certification files; where 480 V is genuinely used, state it in the technical deviation sheet rather than glossing over it — this is exactly what a customer's acceptance engineer will check.
- **The motor side still deserves a glance** — A wide-range control supply does not make the motor wide-range. A 380 V three-phase motor on a 415 V supply sees +9.2%, which is inside the ±10% window of IEC 60034-1 and will run; but in hot, humid pond-side enclosures the thermal margin is thin, so for continuous full-load duty confirm the actual voltage once, or take one frame size up. Same logic for 240 V single-phase in Malaysia.

8.3 Different frequency — the Philippines at 60 Hz

- **A 50 Hz motor must not be connected to a 60 Hz supply** — The Philippines runs 220 V / 60 Hz nationwide, with 380 V or 480 V three-phase for industry. On 60 Hz a 50 Hz motor turns 20% faster; for impeller and fan loads shaft power rises with the square to cube of speed, so the demand reaches 1.4–1.7 times rated power — this is not 'a bit faster', it is guaranteed overload.
- **Three ways out — decide before ordering** — ① Order a 60 Hz motor; cleanest. ② Run a VFD with the frequency clamped to 50 Hz, at the cost of about 17% of output. ③ Size up one frame and run it at 60 Hz. This has to be settled at the order stage; it cannot be fixed in the field.
- **Confirm the three-phase voltage as well** — Both 380 V and 480 V three-phase exist in the Philippines — legacy US-era projects are usually 480 V, local distribution usually 380 V. Ask the customer to photograph the panel nameplate before ordering.

8.4 Power draw, supply and local networks

- **The station draws very little** — Main board DC 12 V at about 0.2 A, probes in the 20 mA class. It can take power from the 485 bus terminals; with many probes, supply it locally instead.
- **4G bands and data plan** — Same module family as the gateway, covering Southeast Asia and South Asia; the SIM is the customer's, an IoT SIM is recommended.
- **Probe life is driven by water quality, not electricity** — Dissolved-oxygen membranes and pH bulbs are replaced on a cycle set by water quality and maintenance; brackish ponds need shorter calibration intervals. That cost dwarfs the electricity — say so at quotation stage.

8.5 Climate and corrosion

- **Hot and humid** — Across Southeast Asia: enclosures IP55 or better with desiccant inside; surge

protection on the incoming supply, essential in thunderstorm areas.

- **Salt spray** — Coastal salt spray attacks terminals and PCB solder joints. Inspect terminals every six months, apply anti-oxidation grease, and specify stainless or coated enclosures.
- **Monsoon flooding** — India, Bangladesh, Myanmar: mount above the historical flood level, run cables on trays or overhead.

8.6 Certification and documents

- **Mandatory certification differs by country** — Vietnam CR (QCVN 4:2009/BKHCN for low-voltage equipment), Thailand TISI, Indonesia SNI, the Philippines BPS/PS or ICC, Malaysia SIRIM / ST, India BIS. Most schemes are mandatory only for certain power ranges — confirm against the local customs requirement.
- **CE and IEC reports are the passport** — Beyond the local schemes, a CE declaration and IEC test reports are the two documents customers ask for most, tenders in particular. Ask before ordering and we ship them with the goods.
- **Language of the documents** — Standard documentation is bilingual Chinese/English. Vietnamese, Thai, Indonesian or Tagalog manuals and nameplates must be requested in advance — they are typeset separately, priced separately, and extend the lead time.

8.7 Five questions before ordering

① Is the pond service three-phase or single-phase? What is the transformer rating?

② What is the measured voltage on site? — the actual reading, not the nominal figure.

③ Is the frequency 50 Hz or 60 Hz? — the Philippines must be confirmed separately.

④ Is the water fresh, brackish or salt? Roughly what salinity?

⑤ Which language do you need for the manual and the nameplate?

This table is a general judgement. Province-level differences — a rural feeder that sits low all year, an extra clearance step at a particular port, a local subsidy scheme — should be added by the local sales team to the project file. For a country not listed here, judge by the same three dimensions: voltage, frequency, certification; if in doubt, ask the factory.

9. Frequently asked questions

Is installation included? No. The quotation covers the equipment only. Installation, posts, brackets, buoys and extra cable are the customer's side; the power adapter and the SIM are bought locally. We can supply a mounting plan and a matching accessories list.

Which SIM card should I use? The unit is plug-in. Export units ship without a card or bundled traffic — insert a local carrier IoT SIM (Viettel, Vinaphone or Mobifone all work). The domestic version ships with a Chinese IoT SIM and three years of traffic. Bands covered are B1 / B3 / B5 / B8 / B41; B28 (700 MHz) is available on request for provinces that rely on it.

Is the cloud platform available in English? Yes, English is the default and Chinese can be switched in. Vietnamese is available as an option, and other languages can be localised per project — tell us at the ordering stage. A basic account is opened with the device and carries no extra charge within the bundled service period. Use beyond that — extra sub-accounts, on-premise deployment, custom development, renewal after the period — is quoted separately, and the final interpretation of the service scope and billing rests with us.

Are calibration solutions included? A starter set is: one bottle each of pH 4.00 / 6.86 / 9.18 and one of ORP 468 mV, enough for commissioning and the first calibration. Refills can be ordered from us or bought locally to the same specification.

Can the units be private-labelled? Yes. OEM/ODM carries a minimum order quantity that depends on model and configuration, and there is no tooling or set-up fee. Silkscreen, colour box and manual can all carry your brand.

Why do some probes carry 2 years of warranty and others 1 year? The DO probe has fewer failure points because fluorescence needs no membrane or electrolyte, so it carries 2 years. pH and ORP are electrochemical electrodes whose glass bulb and junction are consumable, so they carry 1 year. Every warranty period is stated line by line in the specification table rather than folded into one blanket figure.

Does the DO probe need frequent calibration? No routine calibration. It is two-point calibrated at the factory with the coefficients stored in the chip and loaded on power-up. An air-saturation check every 3–6 months is recommended, and recalibration is required after replacing the fluorescent cap.

Integrated or discrete probes for a shrimp pond? Salinity is only available on the integrated probe. If you need DO, pH and ORP only, discrete probes are cheaper to replace but take three ports and three cables. For shrimp ponds we recommend the integrated probe; for fish ponds, discrete probes.

How many probes can one terminal take? Four. Configuration A uses one, B uses three, C uses one. Beyond four, add a second terminal or move to an integrated-probe layout.

Is data lost when the network drops? No. Readings are cached in the gateway and back-filled when the link returns, so the history curve stays continuous.

How often must probes be cleaned? Every 2–4 weeks, and weekly during an algal bloom. Biofouling is the first cause of drifting accuracy — more so than calibration.

Can I see the data remotely? Yes. With 4G upload, phone and PC both show live values and history curves, with push alarms.

10. Packing, delivery and commercial terms

- **Packing** — export packing, terminal and probes in separate cartons, probes fitted with protective caps; carton size and gross weight are fixed once the order quantity is known, together with the

20GP / 40HQ loading quantity.

- **Lead time** — scheduled after order confirmation; stock availability quoted on request.
- **Loading port** — Nansha / Yantian, China.
- **Minimum order** — an MOQ applies, scaled by model and configuration; OEM/ODM carries no tooling or set-up fee.
- **Warranty start** — from the date of manufacture, not the date of arrival.
- **Documents** — English and Chinese operation manual; a Vietnamese version can be prepared on request.
- **Not included** — installation, posts / brackets / buoys, extra cable, power adapter (export units), calibration solutions beyond the starter set, and the SIM card on export units.

11. Contact

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Specifications are subject to change without notice as the product is improved; confirm current data before tendering or volume orders.