

Four Ways to Move a Bike

Power delivery, efficiency, pedal feel and app control across the Bosch Performance Line CX Gen 5, Bosch Performance Line SX, TQ HPR60 and maxon BIKEDRIVE AIR S

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Performance figures throughout are manufacturer ratings. Motor behavior in this category is defined largely by firmware, and firmware changes often.

1. Why These Four

These four drive units are not competitors in the usual sense. They sit at four different answers to the same question: how much of the work should the bike do?

The Bosch Performance Line CX Gen 5 is the reference full-power unit, fitted to more trail eMTBs than any other motor and backed by the deepest service network in the category. The Bosch Performance Line SX is the same company's answer to the lightweight segment, sharing the ecosystem and much of the software but trading torque for a two-kilogram package and a narrower stance. The TQ HPR60 is the purist light-assist option, built around the premise that the rider should still be the engine. The maxon BIKEDRIVE AIR S is the newest argument: full-power output figures in a package that weighs and integrates like a light-assist system.

The characteristics that produce riding feel—such as software response and motor ramp—are largely influenced by motor design, affecting how well the system matches rider preferences and style.

Torque is what the spec sheet argues about. Response, ramp and overrun are what you feel in the first ten minutes.

A note on figures

Power, torque, support ratio, weight and Q-factor figures throughout this paper are manufacturer ratings as published by Bosch, TQ and maxon. We have deliberately not blended in third-party bench measurements, which vary with test protocol, firmware version and test bike, and which invite arguments that distract from the question a customer is actually asking. Where a specification is not published, we say so rather than estimate.

Two structural caveats are crucial: all four systems have received significant firmware updates within the last twelve months, and two have altered their headline torque figures multiple times. This information ensures readers verify current specifications before making build or purchase decisions, emphasizing the need for up-to-date data.

2. System Snapshot

Manufacturer ratings, with the important asterisks attached below the table.

	Bosch CX Gen 5	Bosch SX	TQ HPR60	maxon AIR S
Class	Full power	Light assist	Light assist	Full power output, light assist packaging
Peak torque	Up to 120 Nm	Up to 60 Nm	60 Nm	90 Nm
Factory default torque	85 Nm	55 Nm	60 Nm	90 Nm
Peak power	750 W	600 W	350 W	620 W
Max support ratio	Up to 600%	Up to 400%	200%	400%
Motor weight	Approx. 2.8 kg	Approx. 2.0 kg	1,924 g	Approx. 2.0 kg

	Bosch CX Gen 5	Bosch SX	TQ HPR60	maxon AIR S
Q-factor	Not published for Gen 5	160 mm	135 mm	155 mm
Transmission	Multi-stage geared	Simplified two-stage geared	Harmonic Pin-Ring, single reduction	Planetary gearhead, inline layout
Batteries	PowerTube 400 to 800 Wh	CompactTube 400 Wh	290 / 360 / 580 Wh	400 Wh, 600 Wh
Range extender	PowerMore 250 Wh	PowerMore 250 Wh	160 Wh	250 Wh
Claimed efficiency	Not published	Not published	Not published	85%
Overrun	Extended Boost, adjustable 0 to 10	Extended Boost, adjustable 0 to 10	None to speak of	Short, fixed
Rider app	Bosch Flow	Bosch Flow	TQ app	BIKEDRIVE Connect

Notes on the table

- Bosch torque figures are dynamic by design. The CX Gen 5 launched at 85 Nm and 600 W, but a mid-2025 over-the-air update increased torque to 100 Nm and 750 W. The May 2026 Performance Upgrade 2.0 further raised torque to 120 Nm and support ratio from 400% to 600%, while peak power remained at 750 W. These updates demonstrate the importance of verifying current capabilities before specification comparisons.
- The SX follows the same pattern. It ships at 55 Nm with a 340% support ratio, and from autumn 2025 can be upgraded to 60 Nm and 400% support through the app, with peak power unchanged at 600 W. Adjustable Extended Boost is also available on the SX, which is worth knowing because overrun was previously a CX-only conversation.
- The 120 Nm ceiling on the CX is a drivetrain limit rather than a motor limit. Bosch has publicly indicated that pushing beyond its published figures could shorten drivetrain life, which is a useful thing to be able to explain to a customer who wants to know why the number stops where it does.
- Bosch has not published a Q-factor for the CX Gen 5. The Gen 4 CX was 175 mm, and Bosch describes the Gen 5 housing as narrower and more compact, but we are not going to publish an inferred number. The SX figure of 160 mm is published, and represents a reduction from the 178 mm of earlier Bosch units made specifically in pursuit of a more natural pedaling sensation.
- Peak power on the SX and the AIR S is cadence-dependent in a way the CX is not. Both require the rider to be spinning meaningfully before the full figure is available. The number is accurate. The conditions under which you reach it are not the same across these four.

3. Power Delivery

Three separate behaviors get lumped together as "feel." They are worth separating, because a motor can be excellent at one and mediocre at another.

3.1 Reaction speed and engagement

Reaction speed is how quickly the system recognizes that you have started applying torque, and how much dead time exists between the pedal moving and the motor contributing.

Bosch Performance Line CX Gen 5

Bosch attacked this at the sensor level rather than the power level. The Gen 5 samples pedal input at up to a thousand times per second and adds a six-axis inertial measurement unit that reads incline, tilt and vibration, feeding all of it into the control loop. The practical result is a motor that reads terrain as well as rider input, and the difference shows most in the eMTB and eMTB+ modes where support arrives proportional to what the bike is actually doing.

The most recent firmware adds a function called Drivetrain Tensioner, which addresses engagement lag mechanically rather than through the control loop. While coasting, the software rotates the chainring very slightly to close the freewheel and take up drivetrain slack, so there is no free travel to absorb when you step on the pedals. Bosch positions this as a noise and wear reduction as much as a response improvement, since it avoids the hard metal-on-metal engagement that becomes more punishing at higher torque settings. It is limited to the Gen 5 CX and CX-R units and rolled out in mid-2026.

Bosch Performance Line SX

The SX is the most cadence-dependent unit here, and this defines its engagement character more than anything else. Full power arrives only above roughly 100 rpm, so a rider in the wrong gear on a slow technical section will find it asks for considerably more input than the CX does in the same place. In the right gear, spinning hard, it is genuinely responsive and the ramp is impressive.

Two design details support that. Sprint mode detects the combination of high cadence and high rider power and brings support in more quickly to accelerate toward top speed. Separately, Bosch reduced pedaling resistance by roughly half compared with its other systems, which matters above the assistance cutoff and matters again for a rider who wants the bike to feel like a bike when the motor is off. The trade-off is that responsiveness this sharp takes a few rides to calibrate to.

TQ HPR60

The HPR60 responds quickly and its start-up behavior is more forgiving than the SX in the same category, which is the more relevant comparison now that both are in this document. But the 200% support ceiling means quick response and strong response are not the same thing. The motor is prompt about joining in. It is not going to carry you.

maxon BIKEDRIVE AIR S

The AIR S engages smoothly and predictably with no surge, and this is genuinely one of its strengths. Support comes on gently and stays proportional, which translates directly into rear wheel traction on loose climbs.

maxon describes the system as delivering smooth, consistent power even at high cadences without overheating, and the design intent is precise, even support without resonance or delay.

The important qualifier, as with the SX, is cadence. At low cadence you get noticeably less assistance than a conventional full-power motor delivers in the same situation, and the full-power sensation arrives when you are spinning and putting in real effort. This is a defensible design choice for the intended rider, but it means the 90 Nm figure describes a peak available under specific conditions rather than a shove you can lean on at 55 rpm in a technical switchback.

3.2 Overrun

Overrun is how long the motor keeps driving the chainring after you stop pedaling. Regulation caps this at two meters of unpedaled assistance. It is the single most divisive characteristic in this comparison, and these four take three genuinely different positions on it.

	Bosch CX Gen 5	Bosch SX	TQ HPR60	maxon AIR S
Behavior	Extended Boost, scaled to input length	Extended Boost, scaled to input length	Essentially none	Short, noticeable, fixed
Rider control	Slider 0 to 10 in Flow	Slider 0 to 10 in Flow	Not applicable	None
Best case	Ratcheting the cranks to clear a ledge on a technical climb	Same technique with less torque behind it	Predictability, no unwanted drive into a corner	Small obstacle clearance without the Bosch commitment
Worst case	Unwanted drive in flat, fast corners	Same, though less forceful	Hard work on tech climbs and over obstacles	Not adjustable either way

The Bosch implementation is the most sophisticated and the most polarizing. A short stab at the cranks produces a short overrun; a longer quarter-turn ratchet produces the maximum two-meter extended boost. That proportionality is what makes it a technique rather than a gimmick. Experienced riders use short pedal kicks to lift the bike over steps and ledges without full crank rotations, and in that specific situation the CX is among the most confidence-inspiring units available.

It is also the behavior most likely to annoy a rider who did not ask for it. Drive continuing into a flat fast corner is unwelcome, and until recently turning it off required a dealer visit and the Bosch service software. The May 2026 update finally moved this into rider hands as a 0 to 10 slider per assist mode in the Flow app, and extended the same control to the SX and to fourth-generation CX units. For real-world satisfaction that single change matters more than the torque increase it shipped alongside.

TQ has no meaningful overrun and treats that as a feature. The consequence is honest: rolling over obstacles and clearing technical uphill sections is more demanding, and you will do more of the work. Riders who value predictability above all else read this as the motor staying out of the way. Riders coming from a full-power bike often read it as the motor abandoning them at the worst moment.

The maxon sits between the two. Its overrun is short but perceptible, audible as a soft freewheel click, and it helps carry the bike over small obstacles without pedaling. It is not adjustable, which is the meaningful difference from Bosch here rather than the length itself.

3.3 Feel under sustained load

The CX builds support gradually and evenly, and the Dynamic Control behavior in eMTB+ functions as effective traction control, feeding power in slowly enough that the rear wheel keeps grip. At the assistance cutoff the support fades out smoothly rather than dropping off a cliff. Even at maximum settings it is composed rather than aggressive, which is the main separation between the CX and its more urgent CX-R sibling.

The SX rewards sustained high-cadence effort and punishes the opposite. On a long grinding climb in too tall a gear it will feel thin. Spun properly on the same climb it feels like considerably more motor than 55 Nm suggests, which is the whole design thesis.

The TQ amplifies rather than replaces. Power delivery is smooth, predictable and consistent, and the reward for effort is proportional. Its Harmonic Pin-Ring transmission is described by TQ as near loss-free and free of backlash, which is the mechanical basis for the directness riders report.

The maxon delivers linearly and modulates finely through pedal input. Its power comes back to the rider in proportion to what the rider puts in, which allows very precise control but also means fitness is a prerequisite for accessing the top of its range.

4. Efficiency and Thermal Character

Only maxon publishes an efficiency figure, at 85%, and cites the compact drive and high integration as what makes ultra-light builds under 17 kg possible with either the 400 Wh or 600 Wh battery. Bosch and TQ do not publish comparable numbers. Rather than fill that gap with third-party bench data measured under differing protocols, this section addresses the design factors that actually determine how far a given system will take a rider.

Architecture

The TQ Harmonic Pin-Ring transmission is the most mechanically distinctive design here. It eliminates conventional reduction gearing in favor of a double tooth ring where many teeth engage simultaneously, so force transfers through fewer parts at lower rotational speeds. TQ cites reduced friction, noise and wear as the direct consequences. The practical effect a rider notices is very low unpowered drag, which matters disproportionately on a light bike ridden above the cutoff.

The maxon uses a brushless internal-rotor motor paired with a low-noise planetary gearhead in an inline layout, with part of the unit extending into the down tube rather than outward at the bottom bracket. That layout is what allows a narrow Q-factor alongside full-power output figures.

Bosch runs conventional multi-stage gearing on the CX. The SX drops one transmission stage relative to the CX, which is what makes it roughly 20% more compact and 800 grams lighter, and is also why its efficiency peak sits at higher cadence. The halved pedaling resistance Bosch quotes for the SX is a direct consequence of that simplified drivetrain.

Battery strategy is the real variable

Across these four, battery selection determines range far more than motor efficiency does, and the available options differ sharply.

- Bosch CX has the broadest range in the category, from 400 Wh up to 800 Wh, plus the PowerMore 250 extender. It is the only system here where a customer can meaningfully choose their own range and weight trade-off at the point of purchase.
- Bosch SX is built around the CompactTube 400, which uses higher energy density cells than the larger PowerTube units. Battery compatibility across the SX and CX Gen 5 is a genuine advantage of the shared platform.
- TQ offers 290, 360 and 580 Wh, with a 160 Wh extender compatible with all three. That 580 Wh option paired with a 200% support ratio is the strongest range combination of any system in this paper.
- maxon offers 400 Wh and 600 Wh with a 250 Wh extender, giving 850 Wh combined at the top of the range. The 400 Wh battery weighs 1.8 kg and the extender 1.6 kg. Drawing 620 W from a 400 Wh battery is a short conversation, so battery selection on an AIR S build matters more than on most.

Thermal management

The HPR60 added cooling fins on the underside specifically to improve thermal stability and sustained efficiency under load. This slightly increases the package size but the weight penalty over the HPR50 is around 70 grams.

The AIR S has no active cooling and is deeply integrated, which makes its thermal behavior the most constrained by geometry. maxon states the system delivers consistent power at high cadence without overheating, and points to that as part of what preserves range.

The physically larger CX has the most thermal mass of the four and derates the most gradually as a result. This is the expected advantage of size, and it is the reason the CX remains the sensible choice for long sustained climbing at high assistance in warm conditions.

5. Pedal Feel

Pedal feel is partly software and partly geometry. The software half is covered above. This section is about the physical half, which no firmware update will change.

5.1 Q-factor

Stance width is the most consequential fit variable that eMTB motor selection imposes on a rider, and it is the one least discussed at point of sale. A motor housing has to go somewhere, and on most full-power units it goes between the rider's feet.

System	Q-factor	Position	Note
TQ HPR60	135 mm	Narrowest here	Comparable to most analog mountain bikes
maxon AIR S	155 mm	Narrow for the output	Inline layout keeps width down despite full-power figures
Bosch SX	160 mm	Narrow for a Bosch	Reduced from 178 mm specifically for a more natural pedaling feel

System	Q-factor	Position	Note
Bosch CX Gen 5	Not published	Widest here	Gen 4 was 175 mm; Gen 5 housing described as narrower

The spread across these four is the single most important line in this paper for a rider with existing fit issues. A customer moving from an analog bike to a TQ-equipped build faces essentially no change in stance width. The same customer moving to a CX faces a step change of roughly 40 mm from a typical analog Q-factor, which is large enough to be symptomatic on its own.

Stance width mismatch is a real driver of lateral knee and hip symptoms. The direction of the error matters less than the size of the change from what the rider is already adapted to.

The practical guidance for a build conversation is to establish the customer's current Q-factor before discussing motors, not after. Where a published figure does not exist, as with the CX Gen 5, measure the actual bike. Cleat lateral position and pedal spindle length provide roughly 10 to 15 mm of adjustment range in each direction, which is enough to bridge a modest mismatch and not enough to bridge a large one.

5.2 Drag, noise and mechanical character

The TQ is the quietest of the four by a clear margin, which follows directly from the Harmonic Pin-Ring design and its low rotational speeds. TQ describes the system as the smallest, lightest and quietest in its class.

The maxon is close behind and is among the quietest units available, particularly at partial load. Under full load in steep technical terrain it becomes more audible but stays at a pleasant frequency rather than a whine, and there is no rattle on descents.

The SX is quieter than the CX and was designed with lower noise as an explicit goal, which suits the stealthier positioning of the bikes it goes into.

The CX sits in the middle: noticeable but not intrusive, quieter than Shimano and Pinion, not as hushed as the other three here. The significant improvement in the Gen 5 was the elimination of the freewheel clatter that plagued the Gen 4 on descents, which was the single most common complaint about the previous unit. Drivetrain Tensioner should reduce mechanical engagement noise further.

6. What the App Actually Lets You Change

This is where the systems separate most sharply, and it is the area least visible at point of sale. Note that the two Bosch units share one app and one ecosystem, which is a real advantage for a shop supporting both.

Capability	Bosch CX Gen 5	Bosch SX	TQ app	BIKEDRIVE Connect
Adjustable modes	Custom riding modes across the mode set	Custom riding modes including Sprint	Eco, Mid, High, each individually	Cruise, Sport, Blast, each individually
Support level	Yes	Yes	Yes	Yes
Max power	Yes	Yes	Yes	Yes

Capability	Bosch CX Gen 5	Bosch SX	TQ app	BIKEDRIVE Connect
Peak torque	Yes, up to 120 Nm per mode	Yes, up to 60 Nm	Not exposed	Not exposed
Ramp or dynamics	Yes, Dynamic parameter	Yes, Dynamic parameter	Yes, responsiveness slider	Not exposed
Max speed	Yes	Yes	Yes	Not exposed
Overrun	Yes, Extended Boost 0 to 10	Yes, Extended Boost 0 to 10	Not applicable	No
Ride data dashboard	Yes, extensive	Yes, extensive	Yes	Yes
Battery health data	Yes, via Kiox 400C	Yes, via compatible display	Yes, cycles, self-discharge, temperature exposure	Not published
Battery care modes	Not published	Not published	Yes, gentle charge and storage modes	Not published
Navigation	Yes, offline with preloaded routes	Yes, offline with preloaded routes	No	No
Third-party head units	Garmin Edge via Live Data Interface	Garmin Edge via Live Data Interface	Not published	ANT+ and Bluetooth to Garmin, Sigma, o-synce
Dealer tool	Bosch service software	Bosch service software	Yes	BIKEDRIVE Service
Paid tier	Flow+ for alarm, battery lock, sharing	Flow+ for alarm, battery lock, sharing	None	None

Bosch Flow, covering both CX and SX

The most complete ecosystem here, and the shared app across both Bosch units is a genuine practical advantage. Custom riding modes expose assistance, dynamics, max speed, max power, and now peak torque and Extended Boost on a 0 to 10 scale, per mode. Updates are handled over the air reliably. Diagnostics through the Kiox 400C cover battery health, charge cycles, total operating time and a per-ride breakdown of time spent in each mode, which is useful data for a shop doing a service intake.

Two practical notes. Motor Lock is free but eBike Alarm, Battery Lock and sharing sit behind the Flow+ subscription and in some cases require the ConnectModule. Heart rate support uses the Bluetooth Heart Rate Profile and works with Apple Watch, but excludes several popular chest straps including Garmin units, which will irritate a certain kind of customer.

The installation path for Performance Upgrade 2.0 has a quirk worth knowing before a customer calls: the bike must be registered in the app, and it typically has to be unpaired and reconnected before the update becomes available. The new parameters then appear under Custom riding modes.

TQ

Clean, fast to pair, and the strongest of the four on battery stewardship. All three modes are individually adjustable for maximum power output, support level, responsiveness and top speed via sliders. The technical transparency is the standout feature: charge cycle count, self-discharge rate and time spent at temperature extremes are all visible, which is unusually honest disclosure and extremely useful when evaluating a used bike. The gentle charging mode and separate storage mode can be selected independently and are a meaningful longevity feature the others do not match.

maxon BIKEDRIVE Connect

maxon runs two apps for iOS and Android: BIKEDRIVE Connect for riders and BIKEDRIVE Service for dealers, the latter built so a mechanic can move quickly through troubleshooting and spare part ordering.

On the rider side, maxon describes the Connect app as one that turns the phone into a control center, letting the rider customize support levels and see the important ride data together on a dashboard. The three support levels are Cruise, Sport and Blast, each individually configurable to match riding style. A minimalist control unit integrated into the top tube keeps full control of the system at hand, connecting to a phone over Bluetooth or to Garmin, Sigma and o-synce devices over ANT+, with a discreet handlebar shifter for mode changes on the move.

Rows marked as not published above reflect specifications maxon has not stated publicly rather than functions known to be absent. Verify current app capability against the shipping firmware version on any specific build.

7. Where Each One Fits

Bosch Performance Line CX Gen 5

The right answer for the widest range of riders, which is exactly why it is fitted to the most bikes. Intuitive and predictable in technical terrain, excellent traction through Dynamic Control in eMTB+, mature software, the broadest battery selection, and a dealer and service network nothing else here approaches. The adjustability is now genuinely deep: a rider can run it as an 85 Nm bike with overrun disabled, or a 120 Nm bike with maximum Extended Boost, from the same hardware.

The trade-offs are weight at approximately 2.8 kg, a conventional eMTB silhouette rather than a discreet one, mid-pack noise, and the widest stance of the four.

Bosch Performance Line SX

The bridge product, and often the correct recommendation for a rider who wants Bosch reliability and the Flow ecosystem without a full-power bike. Two kilograms, 600 W peak, a 160 mm Q-factor, roughly half the pedaling resistance of other Bosch systems, and full access to the same customization including adjustable Extended Boost. Battery compatibility with the CX Gen 5 across the shared platform is a real ownership advantage.

It is the wrong motor for a rider who grinds. Peak power above 100 rpm is a genuine constraint, not marketing language, and a customer who habitually climbs in too tall a gear will be disappointed. It is also limited to the 400 Wh CompactTube, so range planning is less flexible than on the CX.

TQ HPR60

For the rider who wants to still be the engine. The most natural ride feel available, the quietest operation, the narrowest Q-factor by a wide margin at 135 mm, the lightest unit at 1,924 g, and the strongest range combination here through the 580 Wh battery paired with a modest support ratio. The 290 Wh and 360 Wh options enable genuinely light builds.

It is the wrong motor for anyone wanting shuttle-like assistance, and the absence of overrun makes technical climbing and obstacle clearance materially harder work. Fitness is not optional.

maxon BIKEDRIVE AIR S

The most interesting product here. Approximately 2.0 kg with 90 Nm and 620 W available, 85% claimed efficiency, near-silent operation, invisible integration, and a 155 mm Q-factor that is narrower than the Bosch SX despite producing full-power output figures. It enables bikes that look and handle like analog trail bikes while climbing at full-power pace, with builds under 17 kg achievable on either battery.

The caveats are cadence dependence and battery capacity. The 90 Nm figure is real but conditional on spinning, and a rider expecting low-cadence grunt will not find it. Drawing 620 W from a 400 Wh battery is a short ride, which makes the 600 Wh option and the 250 Wh extender close to mandatory for anyone doing full days. The ecosystem is also younger than Bosch's, with a smaller service footprint, which is a legitimate consideration for a customer who values dealer support over specification.

Performance specifications in this paper are manufacturer ratings published by Bosch, TQ and maxon, together with TGI Cycling's assessment of how those systems behave in use. It is not based on TGI bench testing. Firmware in this category changes frequently, and specifications should be verified against current manufacturer documentation before any purchase or build decision.

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